ducation Department Bulletin

ublished fortnightly by the University of the State of New York

ed as second-class matter June 24, 1908, at the Post Office at Albany, N. Y., under the act of July 16, 1894

433 ALBANY, N. Y. OCTOBER 15, 1908

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New York State Museum

JOHN M. CLARKE, Director
EPHRAIM PORTER FELT, State Entomologist

Museum bulletin 124

23d REPORT OF THE STATE ENTOMOLOGIST

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1907

ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1908

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STATE OF NEW YORK

EDUCATION DEPARTMENT

Regents of the University

With years when terms expire

New York State Education Department
Science Division, May 6, 1908

Hon. A. S. Draper LL.D.
Commissioner of Education

SIR: I have the honor to communicate herewith for publication as a bulletin of the State Museum, the annual report of the State Entomologist, for the fiscal year ending September 30, 1907.

Very respectfully
JOHN M. CLARKE
Director

State of New York
Education Department
COMMISSIONER'S ROOM

Approved for publication this 7th day of May 1908

A. S. Draper

Commissioner of Education.

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New York State Museum

John M. Clarke, Director

Ephraim Porter Felt, State Entomologist

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23d REPORT OF THE STATE ENTOMOLOGIST 1907

To John M. Clarke, Director of Science Division

I have the honor of presenting herewith my report on injurious and other insects of the State of New York for the year ending October 15, 1907.

The climatic conditions of 1907 have departed widely from those of normal years and, as a result, the development of animal and plant life was exceptionally late. Warm weather came on very rapidly and all vegetation grew at such a rate that insects appeared unable to inflict material damage in many cases, consequently, there has been a remarkable dearth of injurious outbreaks, particularly in the early part of the year, and presumably due largely to this cause. An exceptional event was the capture by Dr Theodore P. Bailey of this city, of two specimens of the exceedingly rare Leucobrephos brephoides Walk. [pl. 2, fig. 1], the specimens being taken the last of April in St Lawrence county and deposited in the State Museum.

Fruit tree insects. The San José scale is one of the most serious insect enemies of the horticulturist. The spread of earlier years has continued, and in places where very little effort has been made to check its ravages, the scale has become remarkably abundant and in some instances at least, practically ruined the entire crop. Our experiments of earlier years show very clearly that a lime-sulfur wash is thoroughly effective in destroying the scale as well

as beneficial in checking certain other insect pests and fungous diseases. We have steadfastly insisted that it was wiser to use some such material than to employ the more easily applied mineral oils or preparations of the same, known as miscible or "soluble" oils, because the latter, under certain conditions at least, may seriously injure the trees. This has been done in the face of a determined effort by certain parties to boom oils and oil preparations as the most available remedies for San José scale. Despite the fact that these last named materials are valuable under certain conditions, it remains true that we must still rely in large measure upon the lime-sulfur wash for the control of this pest. Our conservative recommendations, we believe, have deterred many from seriously injuring valuable orchards by making injudicious use of the more dangerous oil preparations.

The operations of the grape root worm in the Chautauqua region have been observed during the season and, in our judgment, there is a marked improvement over the conditions of earlier years. This change is partly due to the higher price of grapes and the consequent better care and fertilization given the vineyards, though it is possible that natural conditions have been of material service in reducing the numbers of this pest. It is still true that this enemy is abundant in certain limited areas, and danger of serious injury to vineyards here and there is by no means past.

Shade tree protection. Continued devastations by several shade tree pests have necessitated the giving of considerable attention to this phase of economic entomology. A bulletin on the white marked tussock moth and the elm leaf beetle, our two most injurious species, was issued in May and a number of warning articles sent to the press throughout the State. The general result has been exceedingly beneficial and much interest has been aroused. The agitation of earlier years secured the appointment of a forester by the city of Albany. This official was placed in charge of the trees, and the spraying with poison resulted in marked benefit, despite the hindrances incident to work of that character. The city of Troy, through municipal agencies, accomplished considerable along this line. It is only a question of a few years before a number of other cities will be compelled, by the severity of insect depredations, to adopt some protective measures or lose many valuable trees. The experience of the last decade has demonstrated beyond all question the possibility of protecting our trees from injuries by such leaf feeders as the elm leaf beetle and the white

marked tussock moth. It is practical to spray the trees so thoroughly that even in localities where the elm leaf beetle and the tussock moth caterpillars are rather abundant, there will be no serious injury to the foliage, and those interested in this work should insist upon the maintenance of such a standard.

Gipsy and brown tail moths. The work of last year in watching for the appearance of these insects within the borders of New York State has been continued. Many caterpillars of various species, all native we are happy to state, have been sent in by different correspondents, some fearing that they had found one or the other of these pests. These fears, we are pleased to state, were groundless and, so far as known to us at the present time, neither of these species has obtained a foothold within our boundaries, though the gipsy moth has recently been discovered at Springfield and Greenfield, Mass.

Several days in June were spent in the infested territory, investigating in particular the recently undertaken work with parasites. Thousands of these beneficial forms have been brought into this country, taken to the laboratory at Saugus, reared to maturity, the dangerous hyperparasites destroyed and the beneficial forms liberated under conditions favorable to their multiplication. Our investigations showed that certain of these European enemies had survived the winter and there is at least a fair prospect of considerable benefit resulting from this systematic importation of natural enemies. The situation is distinctly more encouraging than was the case last year. A general campaign of repression has been conducted most vigorously and the beneficial result therefrom is easily seen in Boston and vicinity. Furthermore, the federal government, through its Department of Agriculture, is cooperating with the Massachusetts authorities in an effort to prevent the further spread of the gipsy moth in particular. This latter phase of the work consists largely in keeping all highways free from caterpillars, so as to make it impossible for automobiles to carry these leaf feeders into uninfested regions. The gipsy moth is being combated strenuously in Rhode Island and Connecticut and there is a very strong probability that the few insects in the last named state will be speedily exterminated.

Forest insects. There were two outbreaks the past season of exceptional interest. The green striped maple worm, Anisota rubicunda Fabr. was very abundant on sugar maples in Berlin and Stephentown, Rensselaer co., stripping the leaves from large

blocks of forest and proving injurious over hundreds of acres. The snow-white linden moth, Ennomos subsignarius Hübn. was extraordinarily abundant on beech trees in the Catskills, defoliating large areas in and about the township of Hardenburg. Both of these outbreaks are unusual, as neither of these species has been injurious in New York State for some years. Detailed accounts of these insects have been prepared and are given in subsequent pages.

Aquatic insects. The studies of our fresh-water insects have been continued. Prof. James G. Needham has completed his report on the work done at Old Forge, N. Y. in 1905, and the results are given in appendix C. This report is particularly valuable on account of the new methods employed in ecological work of this character and because of its additions to our knowledge of the food of fish. There are in addition biological notes on a number of aquatic forms. This report also embodies a valuable addition to our knowledge of the midges (Chironomidae) by Dr Johannsen. Furthermore, the large amount of new matter, relating to stone flies (Plecoptera) and the caddis flies (Trichoptera), acquired at this time by Messrs Needham and Betten, has been withheld for monographic accounts of these groups. Professor Needham's studies of the stone flies are nearly completed and they will prove an extremely valuable addition to our knowledge of this group. Dr Betten, who has been investigating the caddis flies for the past six years, has nearly completed his report upon these forms. The investigations of these two gentlemen, when published, will constitute in connection with bulletins previously issued by this office, an unrivaled contribution to our knowledge of the aquatic insects of the State, a group which is of great economic importance owing to its value as fish food.

Gall midges. This group comprises among its members, several insects of prime economic importance, such as the Hessian fly, the wheat midge, pear midge and some other destructive forms. Furthermore, there is every probability that some other of our native species may become destructive in the near future. Our investigations have already disclosed hitherto unsuspected injuries by members of this group. We have succeeded in identifying several European forms not previously known to occur in this country. During the season we succeeded in rearing probably well over 100 species, a considerable number of them proving to have been undescribed. Appendix D contains descriptions of over 50 new

species, most of which were reared in 1907, together with a number of preliminary keys. The State collections in this group represent probably over 600 species. We have already described over 250 new forms, and it would not be surprising if, after working over the material, there were nearly as many more to characterize in addition to those previously described by other workers. The classification of our American species has been in a chaotic state, making it practically impossible to identify many of our forms. Our work, now well in hand, will establish, when issued, a much needed classification of this important group. It will be an extensive contribution, presumably of about 800 pages.

The rearing of these insects requires a great deal of time and attention, and the marked success along this line last season was due very largely to the devotion of Assistant Entomologist D. B. Young. The collecting of the insects and the galls in the field also requires considerable time, and much of this work has been attended to by assistant I. L. Nixon. Mr J. R. Gillett, a medical student, was engaged throughout the summer in making microscopic mounts of these insects, some 2000 most excellent slides being prepared.

Gall mites. Several of these extremely minute forms are now recognized as injurious to the fruit interests and it is probable that further investigations will bring to light hitherto unsuspected injuries by the members of this group. It is extremely gratifying to include as appendix B a catalogue of the "Phytoptid" galls of North America by George H. Chadwick, Zoologist.

Publications. Numerous economic articles have been contributed by the Entomologist to the agricultural and local press. The large number of new species of Cecidomyiidae taken in 1907 made it advisable to issue preliminary descriptions of some at least, and a reprint from the report entitled: *New Species of Cecidomyiidae,* published January 30th, characterizes 179 new species. The second volume of *Insects Affecting Park and Woodland Trees* [N. Y. State Mus. Mem. 8] appeared February 25 and has repeatedly proved its value during the past season. The demand for information respecting shade tree pests led to the issuing of a special bulletin on the *White Marked Tussock Moth and Elm Leaf Beetle* [N. Y. State Mus. Bul. 109], which appeared May 10, while the report of the Entomologist, owing to delays, was not issued till July 16.

Collections. The special collecting and rearing of Cecidomyiidae by members of the office staff has resulted in enormous

additions to this group, they being particularly valuable because many of the forms are represented by both sexes, and in not a few instances by the larvae and the gall from which the insects are reared. Other additions to the State collections have been large, there being a total of over 10,000 pinned specimens. A number of very desirable species have been obtained through exchange.

A representative collection of New York State insects is almost necessary for satisfactory work along economic lines. The assembling of a large lot of insects involves far more labor than the average man suspects. The additions to the State collection during the past three or four years have ranged from 10,000 to 15,000 pinned specimens, all of which have to be properly labeled, assigned to their various groups and eventually determined. There has been, since the present Entomologist took charge of this office, an approximately sixfold increase in the size of the State collection. The Federal Bureau of Entomology, through the Smithsonian Institution, has about six trained experts in charge of as many groups of insects, and they in turn have at their command a number of assistants. These men classify and arrange specimens, thus covering (though in much greater detail) a field which we must care for with but two assistants, not to mention the other lines of work. A large proportion of the curatorial work in connection with arranging the collections devolves upon the assistants, and it is a pleasure to state that material progress has been made along this line. Assistant Entomologist D. B. Young has, during the past year, given considerable time to classifying the parasitic wasps, Ichneumonidae, and a portion of the Braconidae and also Hymenoptera belonging to the following groups: Pompilidae, Larridae, Bembecidae, Nyssonidae, Philanthidae, Pemphredonidae and Crabronidae. He has also done more or less incidental work with the Diptera. Assistant I. L. Nixon determined and arranged a number of the solitary bees, Andrenidae, assisted in arranging the Ichneumonidae and determined and arranged many of the Curculionidae. In addition he went over the Hill collection, noticed below, repairing and arranging many of the specimens and is responsible for a portion of the catalogue of this collection.

The Hill collection, an exceptionally valuable addition to the State collections, was received through the generosity of Erastus D. Hill, Carrie J. Hill Van Vleck and William W. Hill, heirs of the late William W. Hill, who desired that the father's work should be maintained as a permanent memorial of his

labors in entomology. This collection, consisting of some 10,000 specimens and representing over 3000 species, is in excellent condition. It contains a large number of native forms as well as representatives from Europe, Asia and Africa. The Nymphalidae, Lycaenidae, Hesperidae, Sphingidae and Noctuidae are particularly well represented, as may be seen by reference to the catalogue published as appendix A. The preparation of this catalogue has devolved upon the assistants in the office, first assistant D. B. Young being largely responsible for its arrangement.

Office work. The general work of the office has progressed without any serious interruption, the Assistant Entomologist being responsible for the correspondence during the absence of the Entomologist. There has been a well sustained popular interest in the search for the occurrence of either the gipsy or the brown tail moth in the State, and as a result a considerable number of insects have been sent in for determination. There has been, owing to conditions unfavorable to insect injury in the early part of the year, some falling off in the correspondence as shown by the following figures: 1447 letters, 598 postals, and 915 packages were sent through the mails and 126 packages were shipped by express.

Nursery certificates. The state of Virginia still insists that all certificates accompanying shipments of nursery stock in this State shall be indorsed by an official entomologist, and upon request of the State Commissioner of Agriculture, we have continued as in past years to indorse certificates issued by his office. The following is a list of firms to whom these nursery certificates were issued during 1907: S. B. Huested, Blauvelt; Dansville Nursery Co., The Rogers Nurseries, Stark Bros., Morey & Son, Bryant Bros., Geo. A. Sweet, G. W. Whitney & Co., all of Dansville; Wheelock & Clarke, George S. Joselyn, T. S. Hubbard, all of Fredonia; Reliance Nursery Co., R. G. Chase & Co., The M. H. Harman Co., Sears, Henry & Co., all of Geneva; Jackson & Perkins Co., Newark; The Fairview Nurseries, Brown Bros. Co., Olver Bros., Western New York Nursery Co., Chase Bros. & Co., Ellwanger & Barry, H. S. Taylor & Co., Greens Nursery Co., all of Rochester; Lake View Nursery Co., Sheridan.

Voluntary observers. Certain of these correspondents of the office have submitted reports at various times during the growing season, though owing to the scarcity of destructive insects there has been a marked decrease in these records.

General. The office is indebted to Dr L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture and to members of his staff, for kindly determining various insects submitted to them throughout the year.

We desire to state in conclusion, that there has been a hearty cooperation on the part of those in touch with the office and a continued demand for our publications. The reports and bulletins issued by this office contain a mass of information which will be of service not only to entomologists but to those interested in the suppression of insect pests.

Respectfully submitted

EPHRAIM PORTER FELT

State Entomologist

Office of the State Entomologist, Albany, October 15, 1907

INJURIOUS INSECTS

Green striped maple worm

Anisota rubicunda Fabr.

This species was responsible, in a large measure, for the extensive injuries inflicted upon the hard maples in and about Berlin, Rensselaer co., N. Y. during late summer. The caterpillars were so abundant over considerable areas as to literally defoliate acres of trees besides inflicting much injury upon many others over an extended tract.

This outbreak commenced in 1906 and at that time was supposed to be the work of the forest tent caterpillar, Malacosoma disstria Hübn., as no specimens were submitted by which its identity could be established. The initial outbreak occurred in a sugar bush a short distance north of Center Berlin, and in 1906 a number of acres were defoliated in this section. The injury in 1907 was first reported to this office August 12, at which time some sugar orchards had been stripped of their leaves and others were badly infested by the caterpillars. A personal investigation of the conditions September 14 showed that this insect had been abundant over an area ranging from the vicinity of Stephentown through North Stephentown, South Berlin and north of Berlin Center, the greatest injury being inflicted in the vicinity of the last named village. The first signs of the infestation were observed a little to the north of Stephentown, on small roadside sugar maples, some of which had lost most of the foliage on the upper branches, while the smallest trees were nearly denuded of leaves. This attack, for some inexplicable reason, appeared to be confined almost entirely to the smaller trees, as not a few large sugar maples along the roadside were exempt from injury. The hills to the east of the road from Stephentown north, showed evidence here and there of extended feeding, while at North Stephentown large tracts were nearly defoliated. Just north of Center Berlin one sugar bush of some six or more acres had been entirely stripped and at the time of our visit the trees were throwing out new leaves [pl. 1, fig. 2]. It is worthy of note that this species has been recorded by Miss Patch as defoliating maples in certain localities in Maine during 1907. Previous outbreaks by this insect have been limited to but one or

two years. Our investigations referred to above showed that in some sections of the infested area at least, healthy pupae were quite abundant and it would not be surprising were the depredations of last year to be repeated over a more extended area in 1908.

Early history. This species rarely inflicts extensive injuries in New York State. Dr Lintner, writing of this form in 1902, states that the caterpillar very seldom appears in harmful numbers in New York or the Eastern States. He adds that it was reported that year from Monticello, Sullivan co., N. Y. on the grounds of Mr John D. Lyon, where a number of soft maple trees had been completely defoliated during the summer. This injury, however, was insignificant compared with the outbreak observed in this State during 1906 and the present season. This species has long been known as an enemy of soft maples, particularly in the Central and Western States. Messrs Walsh and Riley, writing in 1869, state that they have known of maples being badly stripped by this caterpillar, while Townend Glover, the following year, states that it causes considerable injury to silver maples at Washington, D. C. Riley, in 1872, records this species as a serious enemy of soft and silver maples, publishing at that time a brief statement of its injuries in Kansas. Furthermore, he states that many of the soft maples of Lincoln, Neb. were stripped by this pest in August 1888. Messrs Riley and Howard record depredations by this species in Mississippi during the year 1890. Prof. Herbert Osborn, writing in 1897, states that it sometimes strips maples in Iowa. Dr J. B. Smith, in his List of Insects of New Jersey, ranks this form as sometimes injurious to soft maples and more rarely, oak.

Description. The adult insect is a rather heavy bodied moth with a wing spread of about 1¾ inches. It is easily recognized by the pale rose colored fore wings crossed by a broad, oblique, pale yellow band and the pale yellowish hind wings. The body is also yellowish. The males may be recognized by the more pectinate antennae. A nearly white variety of this species has been described by the late Professor Grote.

Pupa. It is about ¾ inch long, shining dark brown and tapering to a rather sharply pointed posterior extremity.

Larva. The full grown caterpillar or larva is about an inch and a half long. It has a yellowish head, is pale yellowish green and is alternately striped longitudinally with eight very light yellowish green lines and seven darker green ones, the latter inclining to black and the median one usually darkest. Laterally, on the

7th and 8th abdominal segments, there is frequently a large reddish area. Furthermore, this caterpillar has on the 2d thoracic segment, just behind the head, a pair of long, black spines, and on the posterior extremity shorter, stout spines on the 10th and 11th segments. These spines are represented on the intervening segments by minute, black points arising from similar tubercles. There are also two lateral rows of short spines similar to the smaller ones in the submedian dorsal lines; the ventral spines being decidedly larger. Spiracles rather large, black.

The eggs, according to Professor Riley, are deposited in

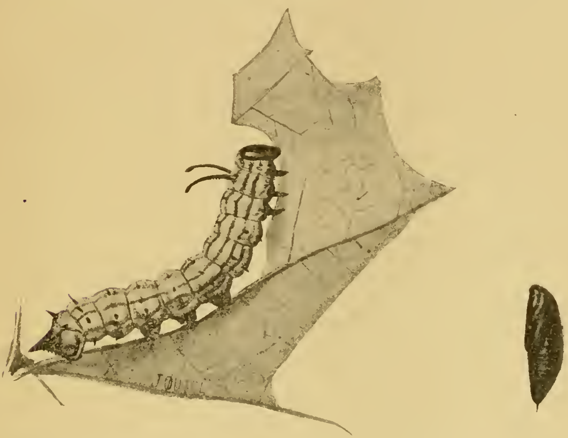

FIG. 1 Green striped maple worm, larva feeding, pupa, natural size. (Original)

batches of 30 and upward on the under side of a leaf. The individual egg is 1/20 of an inch long, nearly oval, somewhat flattened and a translucent pale greenish, becoming yellowish with age and eventually showing the black head of the larva just before hatching.

Food plants. This species feeds by preference on maples and in the Western States at least, exhibits a marked partiality for the soft maple, though our recent experience in New York shows it can thrive on the hard or sugar maple. Dr Lintner states that this species will feed on oak in captivity, while Dr Smith states that it rarely feeds on oak in nature. The attack at Berlin was confined almost entirely to sugar maples, though a

few beech trees adjacent to the defoliated trees, lost most of the leaves on the upper branches.

Life history. The insect passes the winter as the dark brown pupa described above. The pupae are readily found in the vicinity of infested trees, within an inch or so of the surface of the soil. Sometimes they are so abundant that 10 or 15 may be taken in a square foot, though this segregation is probably due to the condition of the ground at the time the worms are seeking shelters for hibernation.

There appear to be two broods of this insect in Pennsylvania and that latitude. Melsheimer, writing to Harris from Dover, southern Pennsylvania in 1842, states that there are two broods of larvae in that section, as he had taken caterpillars toward the end of July and again many hundreds about the last of September. There appears to be but one generation in the North, the moths having been recorded by Professor Packard as appearing about the middle of June. The eggs, according to Dr Riley, are deposited in batches of 30 or more on the under side of the leaves, a single moth laying as many as 142. The young larvae hatch therefrom in 8 or 9 days and about a month later the caterpillars attain full growth, desert the trees and enter the soil to undergo their final transformations; the worms pupating in midsummer in sections where there are two generations, remain in this stage about 14 to 16 days.

Natural enemies. This species is subject to attack by several parasitic insects. Dr Riley records Frontina frenchii Will., Belvosia bifasciata Fabr. and Limneria fugitiva Say as parasites of this form. He also alludes to a record of an egg parasite, probably either a Telenomus or a Trichogramma having been obtained by Mr William Saunders.

It is very probable that a number of our native birds are very efficient destroyers of this leaf feeder. Mr Edward Willbrant of Center Berlin, Rensselaer co., N. Y., had several acres entirely defoliated by this pest, and one of his sons informed the writer that crows had been quite abundant in the infested woodland after the caterpillars became numerous. It is very probable that these birds are of considerable service in destroying the caterpillars, particularly after the latter have attained some size.

Remedial measures. This leaf feeder is easily controlled on more valued shade trees, by thorough spraying with an arsenical poison, such for example, as arsenate of lead. Obviously these

measures are inapplicable to an extended forest area because of the enormous expense involved. The exceptional nature of the outbreak justifies the expectation that it will not continue more than two or three years, and such seems to have been the history in earlier attacks. Practically the only thing that can be done is to take advantage of the situation to emphasize the importance of protecting our native birds, and if possible to create a sentiment which will result in a substantial change in the present popular attitude toward these feathered allies.

The depredations of leaf feeding insects are becoming more severe with advancing years, one of the most striking instances being the widespread injuries inflicted by certain species upon shade trees in our larger cities. The English sparrow, for example, has driven most of our native birds from the confines of our larger cities and, as a consequence, we have periodic outbreaks by the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., a species which has in recent years defoliated thousands of trees in New York cities and villages. This insect, prior to the advent of the English sparrow, was regarded as an innocuous or harmless form, and such is its normal status in the country where native birds, particularly those which feed upon hairy caterpillars, are relatively abundant. The recent extended outbreak of the forest tent caterpillar, Malacosoma disstria Hübn. is another illustration, and the injuries inflicted by this species are probably chargeable, in a large measure, to the great destruction of bird life in recent years. Dr William T. Hornaday of the New York Zoological Society, recently estimated that there has been a decrease of about 48% in the number of our birds during the past 15 years. These figures, taken in connection with the enormous number of insects devoured by birds, are very significant.

Protection and encouragement of birds. The most important step in bird protection, according to E. H. Forbush, Ornithologist of the Massachusetts State Board of Agriculture, is to protect birds about the home and endeavor to increase their numbers. Mr Forbush states that while it may be difficult for the individual to secure a permanent increase of migratory insectivorous birds on his farm, he can augment the number and size of the broods reared on his place, and thus increase the summer bird population. It is also possible to double the usual number of winter visitants. He cites the interesting case of

Prof. C. F. Hodge of Worcester, Mass., who has in three years been able to show an increase of 300% in the native bird population of a city block.

The initial step in this work is to provide conditions adapted to the wants of birds. Mr Forbush states,[1] "that such a place should be so situated as to provide shelter from cold northerly winds and storms. It must be well watered, and should be provided with small patches of coniferous trees, and wind breaks of trees, shrubs and vines. Large groves of pines or other conifers are not particularly desirable as they provide nesting places for crows, jays, hawks and other enemies of small birds. It should have a great diversity of vegetation, including a variety of fruit-bearing plants. A portion of the land should be wooded. If there are too many trees, they may be cut in much less time than it takes to grow them; and those trees, shrubs and vines that are especially attractive to birds may be left. It is well to leave some dead trees or dead limbs in which the woodpeckers can breed, for, unless these birds can be induced to nest about the farm, the trees will suffer from many insidious insect foes."

Mr Forbush mentions white oaks, white or gray birch, the common gray alder, elms, pines, larches and hemlocks as being most attractive to various birds. He also gives in the above cited volume a rather long list of fruit-bearing trees, shrubs and vines furnishing food for birds.

Attracting and feeding the native winter birds is another line of effort productive of much pleasure and at the same time of considerable practical importance. It has been stated, for example, that a pear orchard in New York State, badly infested by psylla, was practically cleared of the pest by nuthatches which worked in the orchard all winter. Many valuable insectivorous birds will remain about the farm if only slight provision is made for their comfort. Mr Forbush states that sparrows prefer some shelter such as thickets and tangles of deciduous bushes and trees and will even take refuge in brush piles. A little chaff scattered about the door, after a snow fall, is very attractive to these birds. He states that certain winter birds readily take shelter in sheds or even in poultry scratching sheds protected by ordinary 2 inch wire mesh. The birds are safe in these latter retreats from both cats and hawks. Mr Forbush recommends as winter food for birds, chaff from barn floors,

[1] 1907 Forbush, E. H. Useful Birds and their Protection, p. 373.

millet seed, sunflower seeds, either in the head or detached, and advises hanging up in the orchard pieces of carrion, suet or other animal food for the benefit of jays and crows. These latter birds resort to such supplies when unable to obtain food in nature and there is much less danger of their molesting the smaller birds or devouring the winter berries upon which the smaller forms depend so largely for sustenance.

Provision should also be made for summer birds if we would have these delightful and beneficial companions upon our premises. Mr Forbush, in order to accomplish this end, recommends the feeding of the early appearing birds in April with a little cracked corn, oats, wheat, barley or millet seed and providing them with suitable bathing places. The latter should be where there is little danger from attacks by cats or owls. The water should range in depth from ½ inch to 2 inches and must be fresh. Nesting places for swallows can easily be provided by making an entrance at least a foot wide in the gable ends of barns not otherwise provided with openings. There should be some provision inside for nesting places similar to the rafters in the old-fashioned structures. Chimney swifts can be induced to remain in the neighborhood by attaching to the barn a box of boards about the size and shape of the old-fashioned chimneys. Mr Forbush states that it is not necessary that this structure be upon the top of the building, though it should be out of the reach of cats. Appropriate nesting places should be provided or made accessible for the other small birds.

The above measures, though perhaps trivial in themselves if only one or more are adopted, are capable of exercising considerable influence upon our bird population, and if generally adopted throughout a given section of the country, should be productive of great practical benefit, since the increased number of birds would be a most important check upon destructive insects.

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Antlered maple caterpillar

Heterocampa guttivitta Walk.

The curious larva of this species is a somewhat general feeder and has attracted more or less notice because of its variable coloring and somewhat remarkable structure. It does not seem to have been hitherto recorded as a destructive leaf feeder. This species was associated with the green striped maple worm, Anisota rubicunda Fabr. in defoliating extensive areas in the townships of Berlin and Stephentown. An idea of the extent of the injuries may be gained by reference to page 13. Caterpillars of this form must have been rather abundant, as a number were sent in with the Anisota larvae August 12, despite the fact that they were then much smaller than this better known form. This species was also very destructive over large areas of maple and beech forests in Maine and injurious to apple trees, as recorded by Miss Patch.

Description. The following characterizations of the various stages have been drafted very largely from Packard's extended descriptions.

Adult. The parent insect is a rather heavy, pale olive-gray moth with a wing spread of 1½ to about 2 inches. The wings are variably marked with white scales and patches and darker scallopings.

Larva. The recently hatched larva of this species is less than 3/16 of an inch long, dull reddish and most remarkable on account of the nine dorsal pairs of chitinous processes, much resembling the antlers of deer, the anterior horns arising from the segment just behind the head. The anterior pair each have four long, curved horns, while the others are smaller and simpler. This curious armature disappears after the first molt and there are then evidences of longitudinal stripes. Successive molts result in great variations in color, in the third stage the ground color being yellowish green and marked by a broad, median, reddish brown stripe, which latter has conspicuous dilations on the third abdominal segment. Subsequently the markings become lighter, the larva being mostly light green with variable reddish brown mark-

ings just behind the head, on the third abdominal segment and near the posterior extremity. The markings vary much in different larvae, there usually being a broad, reddish brown area, frequently forked anteriorly, just behind the head and extending to the first abdominal segment and an irregularly expanded area on the third abdominal segment. The reddish markings at the posterior extremity are more variable, sometimes being rudimentary. The full grown larva is about an inch and a half long, has a rather small head, with the body increasing in size to the fourth abdominal segment, from which it tapers; the posterior extremity being slender, usually elevated and the last pair of abdominal legs extending behind as two small divergent processes.

Pupa. The pupa is rather short, thick, stout, about ¾ of an inch long and with a pair of short, stout, angulate appendages at the posterior extremity.

Life history. This species, according to Dr Packard, deposits eggs at Brunswick, Me., as early as July 3, the larvae hatching therefrom by the 11th or 12th. The young caterpillars feed for a time on the under side of the leaf, at first eating away small, irregular patches. The first stage lasts about nine days, the second probably four or five days. Full growth is attained in about a month, though belated individuals may occur as late as the end of September. The larva, when annoyed, has a habit of jerking its head suddenly from side to side as though trying to drive away some assailant. This species appears to live by preference on sugar maple, red maple and oak, though it has also been taken on apple, chestnut, beech and viburnum. Miss Patch records beech as a preferred food plant in Maine.

Distribution. This insect appears to have a wide distribution, it having been recorded from Florida and Georgia, north and eastward through Maine to St John's Bluff and westward as far as Fort Collins, Col. Dr Packard states that it is a rare species in Colorado.

Natural enemies. These caterpillars are subject to attack by a number of predaceous forms. Miss Patch states that in Maine the fiery ground beetle, Calosoma calidum Fabr., was very abundant about the base of infested trees and that one of the soldier bugs, Podisus modestus Dall., was quite active in destroying the pests.

Remedial measures. The discussion of remedial measures given in our account of the green striped maple worm, Anisota rubicunda Fabr., would apply with equal force to this species.

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Snow-white linden moth

Ennomos subsignarius Hübn.

This species, though generally known some years ago as a destructive enemy of shade trees, has attracted very little notice in recent years. The past summer, however, the caterpillars were found in immense numbers defoliating beech trees in Ulster county. An investigation of the outbreak, made by assistant I. L. Nixon, showed that the area of greatest injury was about half a mile long and

ranged from ⅛ to ¼ of a mile in width. The outbreak occurred on Graham mountain, some 13 miles southeast of Arkville on the west side of a ridge running in a southwesterly direction and at an altitude of approximately 3700 feet. The caterpillars were so numerous that practically all the younger beech trees and the lower branches of the larger trees were completely defoliated, and in a few instances trees 35 to 40 feet high were entirely stripped of leaves, the pest devouring everything except the midrib and larger lateral veins.

Early history. This leaf feeder is best known on account of the serious injuries inflicted by the caterpillars on the shade trees of New York, Philadelphia and other cities prior to about 1880. Mr A. R. Grote, writing of this species in 1881, states that this pest used to be so common in Brooklyn when he attended school there in 1857 and subsequently, "that the horse-chestnuts, elms and maples, the latter especially, became completely defoliated and the brown measuring worms used to hang down and cover the sidewalks ultimately to the great discomfort of passers by." The situation in Brooklyn was so serious in 1861, according to Lintner, that the Common Council contemplated passing an ordinance compelling the removal of all linden trees from the public streets. Other writers in 1866 and later allude to the great injuries inflicted by these caterpillars upon shade trees, particularly those of Philadelphia. A paragraph in *Popular Science Monthly* for 1881 [4:381] states that " for several years the measuring worm preyed on the leaves of the trees in Philadelphia to such an extent that early in the summer scarcely any foliage would be left remaining." This condition continued till the introduction of the English sparrow, which latter, though a serious pest on many accounts, was the means of ridding our cities of this voracious measuring worm. The benefit resulting from the activity of the bird, appears to have been short-lived, as we now have in the white marked tussock moth, Heterocampa leucostigma Abb. & Sm., a pest that appears to be fully as destructive as the species under discussion, though in some respects more easily controlled.

This measuring worm is now coming into prominence as a destructive enemy of forest trees. Prof. J. H. Comstock, in his report for 1880, states that specimens of this Geometrid were received from Mr Adam Davenport of Morgantown, Fannin co., Ga. with the statement that the insects had first been observed in the county two years before, and that they had spread rapidly and

were then destroying forests of hickory and chestnut and, in addition, inflicting much damage on fruit trees. A later outbreak in Iowa was recorded by Prof. Herbert Osborn in 1896. He states that this species was unusually destructive in one of the southeastern counties (Washington), a correspondent of his reporting that the measuring worms had defoliated "acres and acres" of timber land. There is, in addition, the outbreak in the Catskill forests mentioned above.

This measuring worm appears to be making a place for itself among the more destructive leaf feeders affecting some of our fruit trees, particularly the apple. The outbreak in the Georgia forests referred to above, was accompanied by much injury to fruit trees in that vicinity. Prof. H. Garman, writing of this insect in 1904, states that this species has for several seasons been very injurious to an apple orchard in Muhlenberg county, Ky. It would not be surprising if a number of outbreaks, hitherto attributed to our more common canker worms, were in reality the work of this species.

Description. The eggs of this moth are about the size of a small pin head, conical in shape, somewhat compressed at the points. They are first yellowish, then olive-green and later dark brown. They are covered with a thick, sticky, glutinous matter and adhere firmly to the object on which they are deposited.

Larva. Length 2 inches. Head a dull reddish or yellowish brown, the thoracic shield darker and distinctly fuscous along the margins. The body mostly a dull brownish black, the suranal plate and anal prolegs yellowish brown. There are irregular, yellowish markings along the sublateral lines, they being represented by inconspicuous dots on the second and third thoracic segments. On the first abdominal segment these markings are so thick and contiguous in some specimens as to give the appearance of short, sublateral lines extending most of the length of the segment. On the third abdominal segment the yellowish markings are distinctly produced laterally and towards the median line, forming a pair of submedian irregularly oval, reddish yellow marks, very suggestive of tubercles. On the remaining segments this sublateral marking is indicated only by inconspicuous dots, a pair on the anterior and posterior annulets of each segment, the yellow markings becoming a little thicker and more irregular on the 11th, 12th and 13th segments. Head distinctly broader anteriorly, the clypeus sunken, yellowish brown, the labrum pale yellowish with

a few conspicuous yellowish setae, the antennae short, yellowish at the base, the basal segment yellowish, the second segment prolonged, reddish yellow, narrowly yellowish at the extremities and with a few coarse setae apically; mandibles reddish brown, fuscous apically, irregularly bidentate; labial palpi three jointed, mostly pale yellowish, spinneret pale yellowish. True legs a variable yellowish and reddish brown, the distal segments somewhat darker, the first pair of prolegs dark brown basally, yellowish brown apically, the anal prolegs mostly yellowish brown, venter nearly the same color as the dorsum, except that portion between the prolegs, which is a variable yellowish green and yellowish brown.

Pupa. The pupae are found among the leaves, being sheltered by a very light, thin, yellowish brown cocoon. The pupa is about 1 inch long, the general color being a yellowish brown, irregularly spotted with dull black. Antennae, leg and wing sheaths closely fused and extending to the tip of the fourth abdominal segment, the terminal segment pale yellowish or yellowish straw; cremaster composed of an irregular group of four stout, dark brown, recurved hooks, two distal, two subapical and then two pair of more slender ones, the more distal being lateral and the others dorsal.

The adult [pl. 1, fig. 1] is a rather slender bodied, usually snow-white insect having a wing spread of about 1½ inches, the female being a little larger. This moth, according to Professor Packard, may be at once known by its snow-white body and wings, the angulated forewings and notched hind wings.

Life history. The eggs of this species are deposited usually on the underside of the branches and remain unhatched till the following spring. The young measuring worms appear with the unfolding foliage and, when abundant, trees may be defoliated within two weeks. The caterpillars attain full growth in five or six weeks. The investigations of the outbreak in Ulster county were made July 26, at which time most of the caterpillars were full grown and some had even entered the pupal stage. The final transformations are usually undergone within a shelter of leaves drawn and fastened together with silken strands. Adults were bred from the specimens taken in the Catskills July 31 and August 1. The eggs are deposited shortly thereafter, and in the North at least, remain unhatched till the following spring. Professor Comstock states that many eggs in the Georgia outbreak were deposited on leaves, and this led him to conclude that in the South there was probably more than one generation annually.

Food plants. This species is evidently somewhat of a general feeder. Among shade trees, it evinces a marked fondness for linden, horse-chestnut, maple and elm, while in the forests beech, hickory and chestnut are seriously damaged. It has also been regarded as quite destructive to apple under certain conditions and has been recorded as feeding on birch.

Distribution. This species is evidently widely distributed in the eastern United States at least, having been recorded from Nova Scotia south to Georgia and westward to Colorado.

Natural enemies. The English sparrow is a most effective check on this species in cities and it is presumable that a number of our native forms feed upon the caterpillars in the country. It is very probable that the large reduction in bird life in recent years is responsible in considerable measure for increasing depredations by this and other insects. The better protection of native birds must be regarded as one of the most efficient means of preventing insect outbreaks in forests.

A single parasite, Macrocentus iridescens French, has been reared from this species, though undoubtedly other parasitic enemies as well as a number of predaceous forms, prey upon it.

Preventive measures. The preventive measures discussed in the account of the green striped maple worm, Anisota rubicunda Fabr. should apply equally to this pest.

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Apple leaf folder

Ancylus nubeculana Clem.

Examples of leaves infested by this interesting form were received from Cattaraugus county September 17 with the statement that it was doing considerable damage to apple trees in that vicinity. This species is rarely abundant enough to cause material injury, though on account of its peculiar method of operation, it frequently attracts notice and may occasionally cause serious injury. The common name, apple leaf folder, exactly describes the work of the caterpillar, since the dark yellowish green, black marked

caterpillar is most easily recognized by the apposed halves of infested leaves, their edges being held together by strands of silk.

Early history. The dark brown, white marked moth was first described by Clemens in 1860, and the first record of injury is given by the late Prof. Charles V. Riley, who in March 1877, received specimens from Mr O. C. Chapin of East Bloomfield, Ontario co., N. Y. with the statement that in 1876 the trees were seriously injured, one fourth of the leaves being infested. The same year Professor J. H. Comstock of Cornell University, Ithaca, N. Y. noted that the species was common in some orchards of New York State. It also appears to have been numerous in Wisconsin in 1878, since Dr P. H. Hoy writes of it as a serious orchard pest. Dr J. A. Lintner, in his report for 1891, records a case where about one half of the leaves of an orchard at Palmyra, Wayne co. were infested by this species, though he considers the insect of comparatively slight economic importance. This leaf folder has also been recorded as abundant in Ontario (Canada) orchards in 1895 and again in 1903.

Description. The parent moth has a wing spread of about ¾ of an inch, is dark brown and the forewings are marked by conspicuous white areas near the anterior margin and on the posterior margin near the extremity with a rather broad, oblique, whitish stripe. The original description by Clemens follows:

Forewings white with a dark brown dorsal patch extending from the base to the middle of the wing, with its costal edge irregular or doubly curved. The oblique central fascia is almost obsolete except on the middle of the costa where it appears as a dark grayish brown spot, and in the middle of the wing beneath it is a grayish brown round spot exterior to which is a short black dash. The wing above the inner angle is varied with grayish brown and brownish. The costa exterior of the middle is alternately streaked with white and brownish, becoming reddish brown toward the tip. Extreme apex reddish brown.

Pupa. The yellowish brown pupa of this species has been described by Professor Riley practically as follows: Length ⅜ of an inch. The wing sheaths extend to the fourth abdominal segment, the antennal sheaths not quite so far. The anterior and posterior borders of each abdominal segment are armed dorsally with a transverse row of minute decurved spines, anal segment quite sharp.

Larva. Length about ½ inch. Head a yellowish orange, thoracic shield yellowish, the body a variable fuscous yellowish

green. The head is somewhat flattened, labrum reddish brown, the mandibles fuscous apically and the small antennae are whitish basally, pale orange near the middle and semitransparent apically. The large thoracic shield has irregular black markings at the lateral posterior angles, the body is somewhat more fuscous laterally and the setigerous tubercles are rather large, lighter than the body and each bears a single fuscous hair. Anal plate yellowish with a conspicuous irregular, transverse, black spot on the posterior half. True legs with the basal segment fuscous yellowish, the other segments dark brown or black, prolegs pale yellowish green.

Life history. The life history of this species has been summarized by Professor Riley practically as follows: The moths appear in the spring and presumably deposit their eggs upon the leaves, the young larvae hatching in the early part of June. The leaf is folded gradually by drawing the edges together, so that the upper surfaces are nearly apposed and the structure forms a secure shelter [pl. 2, fig. 2]. The caterpillars live in this retreat, feeding only upon the parenchyma and may be found throughout the summer and autumn, there being apparently but one generation annually. On the approach of winter the caterpillar lines the interior of the leaf with silk, and, dropping with it, hibernates in this shelter. The overwintered caterpillar transforms in April or May to the pupa, the latter making its way partly out of the leaf before disclosing the adult.

Distribution. This species appears to be widely distributed in the eastern part of the country at least, it having been recorded from the Atlantic States and as far west as Wisconsin and Minnesota.

Remedies. It is obvious, from this insect wintering in the folded leaves, as given in the account above, that it should be comparatively easy to destroy this pest in badly infested orchards by raking up and burning the dried leaves. Furthermore, this insect is undoubtedly amenable to arsenical poisons, and we have yet to have our attention called to an instance where this pest has appeared in numbers on thoroughly sprayed trees. This is particularly true where the more adhesive arsenate of lead is employed in the later treatments.

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NOTES FOR THE YEAR

This season of 1907 was marked by comparatively few outbreaks by the more common injurious insects. The destructive species affecting fruits, field and garden crops gave comparatively little trouble. The extensive depredations upon shade trees in recent years have done much to bring certain forms into deserved prominence as destructive species. Those occurring upon forest trees have likewise been more numerous, and the recent extensive depredations by certain forms have served to emphasize their economic importance in a most convincing manner. The outbreaks by the green striped maple worm and the snow-white linden moth have been particularly noteworthy, as recorded elsewhere.

Fruit insects

Red-humped apple tree caterpillar (*Schizura concinna* Abb. & Sm.). This leaf feeder, generally distributed throughout the State, is more or less common from year to year. It attracted some notice during the latter part of the summer and more on account of its defoliating young trees in the middle of October.

This latter is somewhat unusual and probably chargeable in part to the backward season. The destruction of the leaves at this late date can hardly be considered as injurious, since it would do little more than hasten the normal fall ripening of the wood.

Lesser peach borer (Synanthedon pictipes G. & R.). This species has long been known as an enemy of plum trees in New York State. Its life history was worked out rather fully in 1879 by Dr James S. Bailey of Albany, who studied the operations of this species on plum trees in his back yard. Subsequent literature shows that this form has a decided preference for the domestic plum, though it has also been recorded as breeding in a number of other trees such as the beach plum, wild plum, cherry, Juneberry, chestnut and peach. Recent developments show that this species may be quite injurious to peach, particularly in the Southern States. Its operations upon this tree have also been observed in New York. This pest has a somewhat similar habit to that of the more common peach borer (Sanninoidea exitiosa Say), it differing in that it apparently attacks none but injured trees, preferring to work in the vicinity of some scar; consequently it is usually found in old trees. The borers make more irregular and longer galleries, generally following the outlines of wounds or along the edges of the cracked bark. They may occur at or a little below the surface of the soil or even above the fork of the larger branches. The borers live on the softer tissues under the bark causing, like the larger peach borer, an exudation of gum. This species is more easily distinguished from the common peach borer by its smaller size, and in the case of the male may be separated from the more common form by its bearing but two yellow bands on the abdomen, they occurring on the second and fourth segments, while the male peach borer usually has a band on the posterior margin of each abdominal segment. The methods of value in controlling the peach borer prove effective in checking this species providing the worming is extended to above the fork of the upper branches. Care should also be taken to prevent injury to the trunk or larger limbs. A more detailed account of this species is given by A. A. Girault in Bulletin 68, part 4, Bureau of Entomology, United States Department of Agriculture.

Lesser apple worm (Enarmonia prunivora Walsh). The work of this species is probably familiar to many of our orchardists, though it has usually been attributed to the operations of young codling moth larvae. This species generally bores just

beneath the skin around the blossom end of the apple or at a point where two apples touch each other, producing an irregular sunken area covered by the unruptured yellowish or yellowish brown skin of the apple. This species rarely penetrates the fruit to the depth of half an inch. Its operations may continue till late in the season, considerable injury occurring even after the fruit has been barreled. The observations of Mr Fred Johnson show that this species was locally quite as abundant and destructive to apples at North East, Pa. during 1906 as the codling moth. It also worked upon the domestica variety of plums. The larva resembles very closely that of the codling moth larva and may be distinguished therefrom by the peculiar comb-like structure, visible with a magnifying glass, on the posterior extremity. It is probable that thorough spraying for the codling moth will control this species very largely. A detailed account of this insect is given by A. L. Quaintance in Bulletin 68, part 5, Bureau of Entomology, United States Department of Agriculture.

Apple maggot or railroad worm (Rhagoletis pomonella Walsh). The work of this native, widely distributed pest appears to become more apparent from year to year in New York State at least, and in some localities this species has been responsible for serious injuries. The parent insect is a blackish, two-winged fly about the size of our common house fly, and conspicuous because of its white banded abdomen and the black bands across its otherwise nearly colorless wings. This insect appears in early summer and deposits its eggs under the skin of the fruit after making a small incision. The wound soon closes and becomes almost invisible, while the young maggot, hatching from the egg, grows slowly, maturing more rapidly as the fruit ripens. The maggots are so active in the latter stages that fruit apparently sound one day may be literally honeycombed by the pests on the next. This is particularly likely to occur in the case of well ripened sweet apples. This species manifests a decided partiality for early apples, some varieties being very badly infested. The presence of the maggots seems to hasten ripening of the fruit, which latter usually drops, and the pests escaping therefrom enter the soil and complete their transformations therein. Breeding continues till late in the fall, the insects wintering under ground as pupae. This insect not only attacks the early sweet varieties, but it is also occasionally injurious to the more valuable winter apples. The injury to these latter is not usually nearly so pronounced and, as a rule, is indicated

simply by irregularities on the surface and rather slightly discolored, corky trails in the interior. This work materially reduces the value of the fruit.

Many a fruit grower has vainly wished for a spray that might be used to control this pest. Unfortunately the greater portion of its life is passed under ground or within the apple, places where it is practically impossible to destroy the pest with the means now at our command. By far the most successful method of controlling this insect is by promptly gathering and destroying the infested fruit. The early sweet varieties can frequently be fed to stock, and in that way some return secured for the labor involved in collecting, or in some instances it may be practical to pasture the orchard so that the wind falls are devoured without further labor. This insect is quite local in habit, appearing to display a marked preference for sheltered hollows. Advantage can sometimes be taken of this habit, and the writer would further suggest that it might be advisable, in places where the pest is quite injurious to winter varieties, that it be attracted therefrom by setting a tree or two of an early variety, say Garden Royal, in the near vicinity and promptly destroying the infested fruit. Should this latter not be done the tree might become a center of trouble instead of a trap to draw away the insects from the more remunerative varieties.

San José scale (Aspidiotus perniciosus Comst.). This pest continues to attract much attention from orchardists throughout the State. The season of 1907 was favorable for its breeding, and in many places where no attempt was made to control the insect, the scale became very abundant by the end of the season. In some instances this was very marked. The breeding was so rapid in some portions of the Hudson valley and in the western part of Connecticut, that the fruit on infested trees was nearly covered by the pest and rendered practically worthless thereby. On the other hand, spraying for this insect has been exceptionally successful in many places throughout New York State. We have in mind one orchard which, at the end of 1906, was very badly infested by scale, so much so that many of the smaller limbs were well incrusted. A thorough application of a lime-sulfur wash was made in the spring of 1907, and as a result of this treatment the fruit crop was practically unspotted. This is only one of several instances which came to our notice. This exceptionally favorable result was probably due in large part to the fact that the spraying was unusually thorough. The experience

of 1907 has demonstrated beyond all question the practicability of controlling the San José scale by thorough applications of a lime-sulfur wash or other material in early spring. This is true not only in young orchards where it is comparatively easy to cover all the trees, but also in larger commercial orchards where spraying is considerably more difficult.

The lime-sulfur wash continues to hold its place as a standard remedy for San José scale. The majority make the application in early spring just before the buds begin to swell, and the results have been uniformly successful. Furthermore, growers of pears are coming to see in this wash a practical remedy for the pear psylla (Psylla pyricola Forst) an insect which in recent years has been exceedingly destructive in some sections of the State. It is also of considerable service in checking the oyster scale (Lepidosaphes ulmi Linn.), the scurfy bark louse (Chionaspis furfura Fitch) and possibly to some extent, plant lice or aphids. In addition, it possesses, as is well recognized at the present time, valuable fungicidal properties. The benefits received in this latter direction are, in the estimation of some of our best fruit growers, more than sufficient to cover the cost of spraying. There can be at the present time no question as to the value of the lime-sulfur wash, so far as controlling San José scale and several other insects is concerned, and even more important than this it is an absolutely safe application. This latter is something of considerable moment to a man interested in producing the largest quantity of high class fruit during a series of years.

There has been in the past considerable objection to the employment of the lime-sulfur wash, partly because of the labor necessary to make the preparation and particularly on account of its caustic properties rendering spraying therewith exceedingly disagreeable for all concerned. This insistent demand has led to the development of a number of miscible or so called "soluble oils" which have been put on the market under a variety of trade names. Certain of these have been used with considerable success, so far as immediate results are concerned, by some of our best fruit growers. The cost per gallon, for example, is considerably greater than that of the lime-sulfur wash, but on the other hand a diluted gallon of this material will cover a much larger surface than does the lime-sulfur wash and spreads more easily, thus making it possible to spray rapidly and in part offset the increased cost of the material. Furthermore, and this is important in sections where winds are

variable in early spring, as is apt to be the case in most parts of New York State, there is no necessity of any preliminary boiling or treatment before operations begin. Taking all of these factors into consideration, Mr W. H. Hart of Poughkeepsie is of the opinion that it costs no more to spray with one of these miscible oils than with a lime-sulfur wash, in spite of the great disparity in the cost of materials. This is undoubtedly very close to the truth but other factors should be considered. Experience in the past has demonstrated that oily applications are not particularly beneficial to fruit trees, and it is yet to be ascertained what results will follow a series of annual applications of these proprietary mixtures. Furthermore, those made by different firms are not alike and it is unsafe to conclude that because one brand is harmless that the same is true of another. These materials should be used, if employed at all, with the greatest caution and the trees sprayed with such mixtures should be carefully watched for indications of oil injury. The results obtained with these soluble oils in 1907, so far as destroying scale is concerned, are practically equal with those given by the lime-sulfur wash. It should be remembered in this connection that the season appears to have been an exceptionally favorable one for destroying the scale, and it would not be surprising if the true relative value of these preparations was somewhat different from that indicated by the experience of the past season.

Grape root worm (Fidia viticida Walsh). The backward season of 1907 had a very pronounced effect upon the development of the root worm as well as upon the growth of vegetation. Many farmers considered the season two to three weeks later than usual, and the same was true of the root worm. Normally this species transforms to the pupa from about June 1st to the 20th, the full grown larvae being near the surface some days at least before pupation occurs. An examination of several vineyards in Westfield, June 4, showed that even on warm soil there was no evidence of transforming to the pupa. Indications at that time were that pupae would not begin to appear in numbers before June 18 and possibly not till the 25th or early in July. Subsequent observations showed that even this was too early, as on July 10 only a few full grown larvae and two recently transformed pupae were to be found on light soil, indicating that these changes had been greatly delayed by the abnormally backward season. An examination of various vineyards at this time indicated that larvae were relatively scarce, this being particularly marked in the case

of the one owned by Mr D. K. Falvay. This vineyard, it may be remembered, was very badly infested by root worms in 1903. The situation then was so serious that a collecting machine was made and over 150,000 beetles taken in the course of two weeks from about five acres. This tract has subsequently received careful cultivation and special attention has been given to cultivating so that the largest number of pupae might be destroyed by this latter process. The result has been that this vineyard has been exceptionally free from this pest during the past three years, probably in a large measure due to the very thorough work of several years ago. An examination at this time, July 10, of other vineyards, led us to conclude that there had been a considerable improvement in some of those that were badly infested a few years before. There were some vineyards where the root worms were somewhat abundant, though so far as our examinations disclosed, the pests were not nearly so numerous as in earlier years. This observation was confirmed subsequently by an examination of a number of vineyards Oct. 16. By far the greater number showed relatively little injury to the vines as indicated by the amount of feeding on the foliage, while in scattered localities there had undoubtedly been large numbers of beetles present and the indications are, in these latter cases, that considerable injury has been inflicted and more may follow next year unless some adequate measures are adopted for checking this pest.

The root worm outbreak in Chautauqua county appears to have passed through the first and most severe stage and we may now expect a period during which this pest will be much less injurious, though it should be borne in mind that so far as individual vineyards are concerned, there is still danger of severe injury here and there throughout the grape belt. It is therefore most advisable for all growers to keep a close watch upon conditions in the vineyards so that destructive tendencies can be promptly checked. Undoubtedly the better care and cultivation given the vines in recent years has had much to do with bringing about these marked improvements, since this treatment has resulted in a more vigorous growth and corresponding resistant powers. It is well known that root worm injury is most likely to be serious on light sandy soils. This is due partly to the fact that the insects seem to thrive better there, and somewhat to the lower resistance of the vines, since we have repeatedly seen vineyards on clayey soils infested by enormous numbers of root worms and yet showing comparatively few signs

of injury. The latter, we believe, is due in large part to the increased vigor of the vines on the heavier soil. Cultivation is an important factor in keeping this pest in check, particularly if operations are so planned that the surface soil under the vines is thoroughly stirred at a time when the majority of the insects are in the pupal or "turtle" stage. The general efficacy of good cultural conditions is further emphasized by the fact that though this insect occurs in certain vineyards in the Hudson river valley, we have yet to hear of serious injuries in this latter section due, we believe, largely to the fact that high cultivation and good feeding has been the rule for some years.

Spraying the vineyards, particularly if a bordeaux mixture is employed, is exceedingly beneficial, not only because of the insects destroyed but on account of the protection afforded from fungous diseases. It is by all means advisable to use a poison in the bordeaux mixture, since this destroys a certain number of root worm beetles and is also very efficient in killing the first generation of the berry worm, Polychrosis viteana Clem.

Shade tree insects

White marked tussock moth (Hemerocampa leucostigma Abb. & Sm.). This destructive leaf feeder was very abundant in a number of cities and villages throughout the State last year and in some places it was present in considerable numbers the past season, despite the fact that many of the conspicuous white egg masses were collected and destroyed. The trees of the city of Albany were pretty thoroughly cleaned, partly by individual work and partly by the newly appointed city forester and his men. This insect nearly stripped many horse-chestnut trees in the city of Buffalo and was more or less destructive in a number of other cities and villages. These attacks occur from year to year and yet no determined efforts are made to check the nuisance. This species, as has been stated many times, is very easily controlled either by removing and destroying the egg masses or by timely sprayings with an arsenical poison. The habits of this insect are such that it would be comparatively inexpensive to so thoroughly clear large districts, that there would be very little danger of injury for a series of years, and so far as individual trees or groups of trees are concerned, they can be protected without reference to the condition of those adjacent unless the branches interlock. All that is necessary under these conditions is to remove the egg masses

and then prevent the invasion of other caterpillars by using a cotton band, sticky band or other device to prevent caterpillars from climbing the trees that have been cleaned.

Elm leaf beetle (Galerucella luteola Müll.). This destructive leaf feeder continues to hold its position as one of the most important insect enemies of elms. Many magnificent trees were seriously injured in Albany, despite the fact that a city forester had been appointed. Part of the trouble was undoubtedly due to the deceptive character of the season, its extreme backwardness possibly leading some to believe that the pest would not be particularly destructive. There were the usual troubles at the inception of operations and this delay was accentuated by the difficulty of securing properly qualified men to do the actual spraying. This latter is very important. The work is disagreeable at best and only conscientious workmen can be relied upon to do the spraying properly. Serious injury to the foliage is the inevitable result of engaging unskilled help, and the condition of the trees in late summer showed that in many instances the application must have been far from thorough, not to mention streets where no spraying was done, owing to lack of time. It seems to be a custom to start one spray outfit and then, if the insect threatens serious injury, to put the second one in commission. This may be somewhat economical of help, but so far as protecting the trees is concerned, a reverse of this policy would be decidedly more beneficial. It would be much better to start two spray outfits at the beginning of the season and keep them going until developments showed that the pest was well under control, rather than to delay and attempt to kill the grubs with poison after they have become nearly full grown and consequently done most of the damage they are capable of inflicting.

Many of the elms in Troy, Watervliet and adjacent cities suffered considerably from this insect, and the same is also true of the magnificent trees of Saratoga Springs. The city of Ithaca suffered greatly from this pest, and unless some radical measures are adopted, many of the elms will be ruined or destroyed within a few years. A spraying outfit was provided in this latter city, through the cooperation of public-spirited individuals, and trees sprayed for all who were willing to meet the bare cost of the treatment. Unfortunately many neglected this opportunity and as a consequence this provision was not so beneficial as might have been the case. The experience of Albany, Troy and other cities along the Hudson

valley show that it is by all means advisable to adopt adequate measures at the outset rather than to lose thousands of magnificent elms. The latter, we are sorry to state, appears to be necessary before municipalities appreciate the destructive possibilities of this shade tree pest.

Experience has shown that there is nothing better for the control of the elm leaf beetle than thorough spraying with an arsenical poison, preferably arsenate of lead in the prepared paste form. The essential to success is an early application of this poison to the under side of the leaves. It is necessary that the spraying be moderately early and, as a rule, we have advised beginning the work as soon as the leaves were about half out, owing to the fact that otherwise it is almost impossible to get over most of the trees in a city before the grubs have attained their growth and caused a great deal of injury. The cost of this treatment is by no means excessive when compared with the value of the trees. Furthermore, the city of Albany expended in 1906 over half a million dollars for the maintenance and improvement of its streets, excluding sewers, while less than one half of 1% of this sum was devoted to the protection of the trees. This is relatively much better than the amount expended by many other cities for the care of their trees. Shade trees are such conspicuous features and add so greatly to the beauty of the streets that it would seem as though a considerably larger proportion of the amount devoted to the maintenance and improvement of the streets, might well be used for the protection of the trees.

Sugar maple borer (P l a g i o n o t u s s p e c i o s u s Say). This insect continues to maintain its reputation as a deadly enemy of the sugar maple, deservedly one of the most popular of our shade trees. Signs of its operations are visible in many of the cities and villages throughout the State, and occasionally one goes into a neighborhood where the insect has become rather abundant and promises to cause great injuries in the near future. Such is the case at Williamsville, Erie co., a small village on the edge of Buffalo. There is a row of about 50 trees a little way out and on the main street, which are very badly infested by this borer. These trees are 25 or 30 years of age, still shapely and in fairly good condition, despite the fact that several are beginning to show the operations of this insect. Eight years ago this row of trees appeared to be practically free from the pest, and it would not be surprising if, in the course of 5 to 10 years, many of these young maples were practically ruined by this attack.

Experience has shown that it is comparatively easy to recognize the presence of this insect, particularly in late fall or early spring, at the time the young grubs have just commenced their operations. The point of entrance is then usually indicated by a slight scar from which sap may be oozing, and a short filament of borings dangling therefrom. Infested trees should be carefully examined for all such indications, the young borers removed and the wounds carefully covered with paint, tar or other protective material. A little time bestowed upon the trees in late fall or early spring should result in practical immunity from injury by this destructive borer.

Miscellaneous

White grubs (Lachnosterna fusca Fröhl.). This species and certain of its allies annually cause considerable damage to various growing crops. The occurrence of these destructive grubs in grass lands, strawberry beds, potato and cornfields and similar places, is a matter of common observation. The past summer our attention was called to a unique form of injury, in that these grubs had destroyed at the State nurseries located at Wawbeek, Franklin co., N. Y., some 2500 to 3000 one and two year old white and Scotch pine seedlings. This form of injury was also observed by State Forester C. R. Pettis in the nurseries located at Saranac Inn. State Forester E. S. Woodruff, who was at Wawbeek at the time of the trouble, informs the writer that one grub would destroy three or four seedlings before being detected. The first year seedlings were usually eaten off near the ground and the leaves apparently drawn down into the burrow and devoured subsequently. There are a number of records of young trees being injured by white grubs, though this appears to be the first instance where this pest has been known to attack the roots of conifers.

Various collections in this section of the country show that our most common species of Lachnosterna is L. fusca Fröhl. It is by far the best represented of any in the State collections, and the extensive series of trap lanterns operated at Cornell University during 1889 and 1892 show that 83% of the June beetles captured were referable to this form. These insects are so familiar as to hardly necessitate description. The adult beetle is a little less than an inch in length, thick-bodied, broadly rounded at both extremities and usually a mahogany-brown color. The familiar white grub is well known as a stout, curved larva lying upon its side and commonly found about the roots of grasses or in strawberry beds. The

life cycle of the June beetle extends over several years. The investigations of Dr S. A. Forbes, State Entomologist of Illinois, who has given particular attention to these pests, show that the life cycle extends over a period of three years. He calls attention to the fact that the European Melolontha vulgaris Linn. completes its life cycle in three years if the season be moist and favorable, whereas under adverse dry conditions the period may be extended to four years, and adds that this European pest has a four year period in the north of Germany and a three year period in the south. He is inclined to believe that our American species may show similar variations in habit. He states that all of our more abundant species begin to transform to the pupa in June or July, changing to the beetle in August or September and then remain in the larval cell till the following March, April or May. This data goes to show that white grubs occurring in the earth later than the middle of September will not change to beetles that year, but under ordinary circumstances winter as grubs and continue their destructive work till the following June. This point is of particular importance to the owners of infested fields, since an examination of the land in the middle of September should enable them to determine with reasonable accuracy the danger of injury by these pests the following year. It is well known that the adult beetles feed upon the foliage of a variety of trees, and there are a number of records showing severe injury, not only to forest trees but also to fruit trees, in which latter case the blossoms may be seriously damaged. Professor Forbes's observations show that the beetles remain in the grass fields during the day and that at about dusk there is a simultaneous movement of the beetles from the field to the forests, they returning again in very early morning, ordinarily before 4 a. m.

Another species, known as the green June beetle or fig eater, Allorhina nitida Linn. deserves notice in this connection, because though southern in distribution, it occurs on Long Island, occasionally in great abundance. This grub closely resembles, in a general way, our ordinary white grub, except that it is somewhat more hairy and it may be readily distinguished from our more common species by its peculiar method of locomotion. These grubs, when moving, turn upon the back and progress in a peculiar undulating manner by successive contractions of the body segments. This larva, according to Dr Howard, unlike the northern forms, frequently emerges from its burrows at night and apparently is not very injurious to living plants, since it has been found to be excep-

tionally numerous in lawns that presented every appearance of being in excellent condition. The adult beetle is sometimes very abundant and destructive because of its devouring fruits such as apricots, peaches, figs, prunes, plums, apples and grapes.

The June beetles have a number of natural enemies. One of the most important is probably the malodorous skunk, a mammal which, when left to itself, destroys countless numbers of the white grubs. Unfortunately, so far as the pest under consideration is concerned, this natural enemy is altogether too scarce. The racoon, the fox, moles and gophers are all credited with feeding upon these grubs. It is well known that the much maligned crow feeds upon the white grub and undoubtedly renders valuable services to the farmer in this way. Domestic fowls frequently follow the plow in search of these pests.

This insect has a number of parasitic forms which prey upon it. There is a slender, jet-black, wasplike creature known as Tiphia inornata Say which is a particularly effective check. This little insect enters the ground, and following along the burrows of the grub, stings its prey and deposits its egg upon the helpless grub. Another common parasite of the white grub is Ophion bifoveolatum Brulle. Professor Forbes has succeeded in demonstrating the parasitic habits of Macrophthalma disjuncta, a small Tachinid which he has reared from the larva. Sparnopolius fulvus Wied. is also a parasite of this pest, while Pyrgota undata is exceptionally interesting because of its being parasitic upon the adult beetles.

There are several fungous diseases which are useful in destroying insects, and Professor Forbes has conducted some experiments with certain of these forms for the purpose of testing their value under American conditions. A number of grubs were destroyed, but further work is necessary before this method can be recommended for use under ordinary field conditions. A most interesting fungus known as Cordyceps ravenelii Berk., affects the white grub, growing from just behind its head and producing usually two long, greenish processes much resembling young seedlings; later these become brownish. Affected specimens attract notice because of their peculiar appearance.

Remedial and preventive measures. White grubs are well known frequenters of grass lands, and it is obvious that considerable injury can be avoided by planting recently turned sod to some crop not likely to be damaged by these pests. Corn, for example, is much

more likely to be affected if planted on sod than were it to follow clover, some small grain or even corn. Badly infested land can be cleared to a considerable extent by pasturing with hogs. Professor Forbes records one case of where a 10 acre lot was pastured for 20 days with a lot of hogs, and at the end of that period there was a reduction of about 86% in the number of grubs.. June beetles deposit their eggs by preference where there is a surface growth of vegetation, consequently cornfields kept free of weeds in June are much less attractive to the beetles than weedy areas, hence clean cultivation may be considered an important factor in avoiding injury. Fall plowing is another measure which should be mentioned in connection with clean culture, since it is now well known that many of the pests in badly infested fields can be destroyed in this manner, provided they are in their pupal cells. This treatment appears to be fatal alike to pupae or recently transformed beetles. Owing to the triennial life cycle this measure would be most serviceable the fall before the beetles are most abundant; namely, at three year intervals.

White grubs are occasionally found inflicting serious damage to cultivated crops such as strawberries. One of the best methods of fighting the pests under such conditions, if labor is not too expensive, is to simply dig out and destroy the grubs. A little experience will enable an intelligent man to go over a large field in a comparatively short time. White grubs in nursery beds, as noted above, may be fought in the same way, or if the insects are too abundant and the area too large, resort may be had to treatment with a kerosene emulsion. The standard formula should be diluted with about six parts of water and the ground on either side of the affected plants thoroughly wet with the preparation. This should preferably be done a little before a rain or else followed with a liberal watering with a hose. The latter application washes the insecticide down and brings it into contact with the grubs. This method has proved very successful in killing white grubs in lawns and should be equally effective in the nursery row. Some care should be exercised not to put too much of the mixture about the plants, as kerosene injudiciously used is very dangerous to plant life. Under certain conditions it may be advisable to take advantage of the beetles swarming in trees at night, from which they may be jarred and destroyed in large numbers. Many are also attracted to lights and could be destroyed in trap lanterns, but ordinarily these two latter methods are not to be recommended for our conditions.

Epizeuxis denticulalis Harv. This species, kindly determined provisionally as this form by Dr Dyar of the United States National Museum, must have been unusually abundant in the vicinity of Palenville, N. Y., judging from the report sent by Mrs Hiland Hill July 29, 1907. She states, in a communication written on that date, that hundreds of these relatively unknown moths were upon the walls of the kitchen and they were also very abundant about the barn and other outbuildings. They were so numerous that considerable apprehension was felt lest they might prove to be the dreaded brown tail moth. It is very probable, considering that the larva of the closely related E. lubricalis Geyer feeds upon grass, that the caterpillar of this species may have similar habits, though it is possible that it may subsist upon dried vegetation, as has been recorded of E. aemula Hübn. The evidence at hand would seem to favor the latter conclusion, as the moths were exceedingly abundant in the barn and buildings where there was presumably a goodly supply of dried provender upon which the caterpillars could subsist. Should such prove to be the case, this species must be classed with the much better known clover hay worm, Hypsopygia costalis Fabr. as a species liable to injure stored hay. This last named species is occasionally rather abundant about barns in New York State, though it is rarely that the insect becomes so numerous as to cause great injury. The moth under discussion has a wing spread of about 1 to 1.2 inches. It is a variable gray, white marked species closely related to E. lubricalis Geyer, from which it may be separated, according to Dr Smith, by its dull, pale luteous ground color powdered with brown scales, and the blackish transverse lines. It is distinguished from the pale forms of lubricalis "by having the space between the median and transverse posterior line dark filled toward the inner margin, which gives the wing a quite characteristic appearance."

Archips sorbiana Hübn. This species, determined by Dr H. G. Dyar, of the United States National Museum, by comparison with specimens named by Lord Walsingham, was brought to Albany in April 1906 on Japanese maples imported direct from Japan. The young trees were kept in a greenhouse and as soon as it was learned that they were infested, measures were taken for the destruction of all the insects, and it is presumable that the species did not succeed in establishing itself in this section of the world. As there is danger of similar importations, this occurrence has been placed on record and a description of the adult and larva prepared. This

form is widely distributed in Europe, Asia and eastward to Japan. It has been recorded by Meyrick[1] as common in England and central Europe. He states that the larvae feed on oak, birch, hazel etc., while Rouast[2] has recorded it as feeding upon pear, cherry and oak. The larvae drew the leaves of the Japanese maple together into an irregular, somewhat cornucopia-shaped mass in which they transformed to the pupa.

The adult moth has a wing spread of ¾ of an inch and the general plan of markings is somewhat similar to our native Archips argyrospila Walk., though the general color is much darker. The antennae, head and thorax are a rather dark fulvous brown, particularly the latter. The forewings are a dark reddish brown and a light yellowish brown, with narrow, transverse purplish brown markings at the extremity. There is a variable dark brown stripe along the basal third of the costal margin, ending in a rather broad, oblique, dark reddish brown and yellowish brown stripe extending nearly across the wing to the outer angle. There is a distinct semioval, dark brown mark on the distal third of the anterior margin, which latter is continued as an indistinct lighter, yellowish brown, tapering mark nearly to the posterior border of the wing. The basal third of the wing and the portion lying between the oblique mark is a variable yellowish brown with intermixed purplish brown scales. The tip of the wing, except that part shaded by the outer oblique line, is yellowish brown with the veins and a series of irregular, narrow, transverse lines more or less distinctly marked by purplish scales. Hind wings dark purplish brown, fringe of both wings pale yellowish brown. Abdomen a variable yellowish or yellowish brown and posteriorly ornamented with long tufts of yellowish brown scales.

This moth differs from the native species at hand by its darker color in connection with the narrow, irregular, transverse lines on the outer portion of the wing.

The larva is about 1 inch long. Head light amber, mouth parts darker; thoracic shield light amber, lateral and posterior margins dark brown or black. Body dark olivaceous, with a subdorsal row of distinct whitish tubercles, dorsal vessel slightly darker; lateral ridge and ventral surface semitransparent, yellowish green. True legs black, prolegs whitish transparent. The caterpillar is sparsely clothed with fine, whitish hairs. Lateral and subventral tubercles inconspicuous, as they are concolorous with the paler portions of the larva. Some of the larvae are somewhat lighter, having lighter, subdorsal stripes, and in one smaller individual the dorsum is very little darker than the venter, with darker, indistinct, broken, sub-

[1] A Handbook of British Lepidoptera. 1895. p. 531.

[2] 1883 Catalogue des Chenilles Europennes Connues, p. 127.

lateral stripes. Another larva, probably belonging to the same species though feeding upon a different maple, presented the following characteristics. Head light amber, mouth parts darker; thoracic shield dark amber with the lateral and posterior margins a dark green. Body a dark olivaceous green with conspicuous, whitish, round, subdorsal tubercles, these latter being large enough so as to suggest, in certain lights, a light, subdorsal stripe; lateral ridge and ventral surface yellowish transparent, tubercles thereon equally as prominent as those in the subdorsal region but less conspicuous, as they are unicolorous. True legs sooty transparent, black at the articulations, prolegs concolorous with the ventral surface. This larva is sparsely clothed with very long, slender, whitish hairs. Described from a single living specimen, which may prove to be a younger stage of the form characterized above.

Birch leaf Bucculatrix (Bucculatrix canadensisella Chamb.). This insect was extremely abundant in New York State during the fall of 1901, at which time a very considerable proportion of the birch foliage was thoroughly skeletonized. Its work in that year was observed throughout the western two thirds of Massachusetts as well as in the eastern and northern parts of New York State.

This species was present September 18, 1907, in large numbers at Arlington, Staten Island, where a considerable proportion of the birches had the leaves seriously affected. The insect appeared to be numerous over an extensive tract, many of the trees being well dotted with the characteristic, circular, white, pseudo cocoons of the larvae. None had constructed the peculiar ribbed, white cocoons in which the species hibernates.

Leucobrephos brephoides Walker. The year of 1907 was made notable by Dr Theodore P. Bailey of Albany taking in April, two specimens of this rare species in St Lawrence county. Dr Bailey was fishing and his attention was attracted to these rapid flying moths hovering over some stones near a stream. The insect, kindly determined by Dr H. G. Dyar of the United States National Museum, is extremely rare in collections, not being represented by specimens in either the National Museum or the New York State collections prior to this season. The moth [pl. 2, fig. 1] has a wing spread of almost one inch, is dark brown, the forewings being marked with a broad, angulate, yellowish white subterminal line, while the hind wings bear an irregular, large, angulate, yellowish white blotch near the middle. The antennae of the male are pectinate while the body is thickly clothed with long, dark brown hairs. Dr James Fletcher of Canada records taking this species April 16

in the Yukon territory and states that he has two specimens of the dark form taken in Labrador in 1894. The adults are quite active and owing to their being abroad so early in the season may have been frequently overlooked by collectors. A close ally, Brephos infans Moschler, occurs in early spring in the vicinity of Albany and is quite different from this circumpolar species, it being larger, with reddish brown tints, and on its hind wings a deep orange colored area, the latter curiously margained in the anal region by a triangular, dark brown area and with a small, oval, dark brown area near the discal cell.

Periodical cicada (Tibicen septendecim Linn.). The occurrence of the periodical cicada is of exceptional interest on account of the prolonged interval occurring between broods. The conditions on Staten Island appear to be unusually interesting. There was, it will be remembered, a large brood on Long Island in 1906 and one pupa was discovered on Staten Island by Mr William T. Davis and in June he heard an insect call at Richmond valley. This species was evidently numerous on Staten Island in 1907. This brood appears to have escaped notice prior to 1890, at which time Mr Davis found three pupal skins at New Brighton and an adult was seen by his sister on a tree trunk. A specimen was also observed by Mr Leng near the Moravian cemetery. The following observations upon the occurrence of this insect in 1907 are transcribed from Mr Davis's notes:

From the records of 1890 it was to be supposed that some evidence of the small and scattered brood of the periodical cicada, now known as no. 15, would be found in 1907 on the island, and in the neighboring parts of New Jersey. On March 31st Mr Alanson Skinner gave me a pupa that he had found under a stone at Woodrow. On June 22d I heard several 17-year cicadas singing in the trees at Woodrow and vicinity, and found two pupa skins on an apple tree on the farm of Mr Isaac Wort. Mr Wort had also heard the cicadas at various times, and he presented me with a pupa that he had found some time before my visit. The following day a cicada was heard at Watchogue at the other end of the island. Later in the summer, while with Mr Henry Bird in the Close valley, we each found a pupa skin of the 17-year cicada. Mr Charles P. Benedict informs me that he found in June several pupa skins as well as fully developed cicadas at his home on the Manor Road, West New Brighton.

In New Jersey the 17-year cicada occurred at Westfield, Plainfield and Newfoundland.

It will be seen from the foregoing that the individuals were quite numerous and no doubt sufficiently so to insure the insect's appearance in 1924.

The above records seem to establish beyond question the identity of a brood which has hitherto been ignored. The insects can hardly be considered as stragglers from the brood of the preceding year since they were more abundant in 1907. It is interesting in this connection to note that Mr Davis records the presence in 1892 of several cicadas at West New Brighton, Logan Springs and Rossville, and we therefore should expect some to appear in 1909, another year when the presence of the 17-year race has not been recorded. Furthermore, Mr Davis states that cicadas were fairly numerous June 11, 1893, near Willow brook and later along Logan spring brook. Specimens were also taken at West New Brighton. These latter may be precursors of the large brood, number 2, due to appear in 1911.

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1907. Forty-one are given with title,[1] time of publication and a summary of the contents of each. Volume and page number are separated by a colon, the first superior figure gives the column and the second the exact place in the column in ninths: e. g. 71:969[27] means volume 71, page 969, column 2, in the seventh ninth, i. e. a little more than two thirds of the way down.

Scurfy Scale. Country Gentleman, Oct. 18, 1906, 71:969[27]

Spraying in early spring with a contact insecticide is advised for the scurfy scale, Chionaspis furfura Fitch.

Celery Blight and Scale. Country Gentleman, Oct. 18, 1906, 71:971[15]

The San José scale, Aspidiotus perniciosus Comst. is identified and thorough spraying with a lime-sulfur wash advised.

Canker Worms in Orchard. Country Gentleman, Dec. 20, 1906, 71:1187[42]

Remedies discussed with special reference to banding materials, particularly "tree tanglefoot."

Squash Bug. Country Gentleman, Dec. 27, 1906, 71:1208[36]

This insect, Anasa tristis DeGeer, is identified and its life history and remedial measures briefly discussed.

Tree Bands. Country Gentleman, Jan. 3, 1907, 72:8[24]

Brief discussion of banding materials with special reference to canker worms.

New Species of Cecidomyiidae. N. Y. State Mus. Bul. 110. 22d Report of the State Entomologist 1906. Separate, p. 1–53. 1907.

Issued Jan. 30, 1907.
Describes 179 new species.

The Gipsy and Brown Tail Moths. Rural New Yorker, Feb. 2, 1907, 66:86

Summary statement of the injurious nature of Porthetria dispar Linn. and Euproctis chrysorrhoea Linn. with special reference to the farmer and fruit grower.

[1] Titles are given as published and in some instances they have been changed or supplied by the editors of the various papers.

Insects Affecting Park and Woodland Trees. New York State Mus. Mem. 8, 2:333-877

Issued Feb. 25, 1907.

Contents

Bark Louse. Country Gentleman, Apr. 4, 1907, 71:336[18]

Methods of control for the apple bark louse or oyster scale, Lepidosaphes ulmi Linn. discussed briefly.

Gall Gnats or Cecidomyiidae. Canadian Entomologist, 39:143-44

Brief account of the group with special reference to methods of collecting.

Fleas. Country Gentleman, Apr. 18, 1907, 72:384[36]

Brief discussion of remedial measures with special reference to barns.

White Grubs and Wire Worms. Country Gentleman, Apr. 25, 1907, 72:421[11]

A summary discussion of the life history and habits of these pests with special reference to control measures.

Scale and Plant Lice. Country Gentleman, Apr. 25, 1907, 72:421[26]

Brief economic notice of the scurfy scale, Chionaspis furfura Fitch and of apple aphids.

Protect the Trees. Albany Evening Journal, Apr. 25, 1907; New York Tribune, Apr. 29, 1907; Poughkeepsie Eagle, Apr. 29, 1907;

Buffalo Courier, Apr. 29, 1907; Rochester Democrat and Chronicle, May 16, 1907, and a number of other papers.

A warning notice respecting the elm leaf beetle, Galerucella luteola Müll. and the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm.

Two Destructive Borers. Suburban Life, May 1907, 4:300[21]

Brief general account of the sugar maple borer, Plagionotus speciosus Say and the leopard moth, Zeuzera pyrina Fabr.

White Marked Tussock Moth and Elm Leaf Beetle. (Hemerocampa leucostigma Abb. & Sm., Galerucella luteola Müll.) N. Y. State Mus. Bul. 109, Entomology 27. 1907.

Issued May 10, p. 1–31, 8 pl. (2 colored).

Contents

Gipsy and Brown Tail Moths. Country Gentleman, May 16, 1907, 72:483[11]

A summarized discussion of the Massachusetts' report on work against these insects, (Porthetria dispar Linn., Euproctis chrysorrhoea Linn.) during 1906.

Report of the Committee on Entomology. N. Y. State Fruit Growers Ass'n Proc. 1907, p. 25–28

Notes and observations on the yellow-necked apple tree caterpillar, Datana ministra Abb. & Sm., the red-humped apple tree caterpillar, Schizura concinna Abb. & Sm., the gipsy moth, Porthetria dispar Linn., the brown tail moth, Euproctis chrysorrhoea Linn., oriental slug caterpillar, Cnidocampa flavescens Walk., scurfy scale, Chionaspis furfura Fitch, San José scale, Aspidiotus perniciosus Comst., and the grape root worm, Fidia viticida Walsh.

Three Imported Pests. N. Y. State Fruit Growers Ass'n Proc. 1907, p. 144-49

A summarized discussion of the gipsy moth, Porthetria dispar Linn., the brown tail moth, Euproctis chrysorrhoea Linn., and the oriental slug caterpillar, Cnidocampa flavescens Walk.

Cecidomyia acarivora n. sp. Entomological News, June 1907, 17:242

Original description of both sexes and larva.

Cecidomyiidae: A Statement. Canadian Entomologist, June 1907, 39:197-98

Summary statement of our plans and methods of work in this group.

Two Common Orchard Scales. Country Gentleman, June 6, 1907, 72:552[11]

Summary account with remedies, of the scurfy bark louse, Chionaspis furfura Fitch and the apple bark louse, Lepidosaphes ulmi Linn.

Wheel Bugs. Country Gentleman, June 20, 1907, 72:593[12]

Brief general notice of wheel bugs, Arilus cristatus Linn.

Whale Oil Soap. Country Gentleman, June 27, 1907, 72:618[24]

Observation on composition and preparation of this insecticide.

Beet Leaf Miner. Country Gentleman, July 4, 1907, 72:638[26]

Brief economic account of the beet leaf miner, Pegomyia vicina Lintn.

Apple Maggot or Railroad Worm. Country Gentleman, July 4, 1907, 72:640[16]

A brief general account of the apple maggot or railroad worm, Rhagoletis pomonella Walsh, with special reference to repressive measures.

Shade Tree Protection. Albany Argus, July 7; Albany Evening Journal, July 8; Troy Times, July 8; Troy Press, July 8; Cohoes Dispatch, July 8; Glens Falls Times, July 9; Times Union (Albany), July 9; Mechanicville Mercury, July 13

Brief warning notice respecting the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm. and the elm leaf beetle, Galerucella luteola Müll.

Apple Plant Lice. Country Gentleman, July 11, 1907, 72:658[36]

Brief general economic notice of apple plant lice with special reference to the rosy aphis, Aphis pomi DeG.

Mottled Willow Borer. Country Gentleman, July 11, 1907, 72:660[11]

Brief general account of the mottled willow borer, Cryptorhynchus lapathi Linn. with special reference to methods of control.

22d Report of the State Entomologist on the Injurious and Other Insects of the State of New York. N. Y. State Mus. Bul. 110, Entomology 28, p. 37–186, pl. 1–3, 1906.

Issued July 16, 1907.

Contents

The Elm Leaf Beetle. The Troy (N. Y.) Times, July 18, 1907

A summarized account of the elm leaf beetle, Galerucella luteola Müll. with special reference to methods of control.

Root Worms and Other Insects in Chautauqua Vineyards. Grape Belt (Dunkirk, N. Y.) July 19, 1907, p. 1; Jamestown Journal, July 19

A summary account of present conditions with special reference to the work of grape root worms, Fidia viticida Walsh.

The Welfare of Our Shade Trees. Troy Times, Aug. 7, 1907; Albany Evening Journal, Aug. 7; Amsterdam Recorder, Aug. 10; Niagara Falls Journal, Aug. 12; Olean Times, Aug. 14, and several other papers

A brief plea for the better protection of shade trees in cities and villages

Bag Worm. Country Gentleman, Aug. 15, 1907, 72:758[26]

Brief general notice of the bag worm, Thyridopteryx ephemeraeformis Haw. with special reference to control measures.

Squash Borer. Country Gentleman, Aug. 22, 1907, 72:778[14]

The employment of trap vines supplemented by cutting out and destroying the borers is advised for the squash borer, Melittia satyriniformis Hübn.

Horticulture: Diseases and Pests. N. Y. State Lib. Bul. 113. Legis. 33. 1907. p. 64–65

Issued Sept. 4, 1907.
Review of legislation for 1906.

Potato Bugs. Country Gentleman, Sept. 12, 1907, 72:861[35]

Observations on the local abundance of potato beetles, Doryphora decimlineata Say and the effect of paris green on potato blight.

Bag Worms. Country Gentleman, Sept. 12, 1907, 72:861[45]

The habits of bag worms, Thyridopteryx ephemeraeformis Haw. are outlined and remedial measures briefly given.

What Makes Hickory Galls. Garden Magazine, Oct. 1907, p. 154–55

Brief life history of the hickory gall aphid, Phylloxera caryaecaulis Fitch with discussion of remedial measures.

Mole Cricket. Country Gentleman, Oct. 3, 1907, 72:928[35]

Brief general descriptive account of the mole cricket, Gryllotalpa borealis Burm.

Gipsy Moth (Porthetria dispar Linn.) Report of the Commissioner for the Suppression of the Gipsy and Brown Tail Moths (R. I.), 1906, p. 71–72

Suppression rather than extermination is advocated where there is a large infested area.

CONTRIBUTIONS TO COLLECTION OCT. 15, 1906–OCT. 14, 1907

The following is a list of the more important additions to the collections.

DONATION

Hymenoptera

Sphex ichneumonea Linn., adult, Aug. 20, **Miss Hazel C. Hilton**, Old Chatham, N. Y.

Pelecinus polyturator Dru., adult, Sept. 5, **L. F. Brown**, Cobleskill, N. Y.

Andricus seminator Harr., wool sower, gall on oak, June 10, from Washington, D. C. and A.? petiolicola Bass., oak leaf stalk gall, June 23, from East Orange, N. J.; both from **Miss E. G. Mitchell**, Washington, D. C.

A. singularis Bass., oak leaf apple gall on oak, June 17; Rhodites bicolor Harr., spiny bullet gall on rose, June 17, from Shushan, N. Y., **S. H. Burnham**, Albany, N. Y.

Coleoptera

Xyleborus dispar Fabr., pear blight beetle, adult on peach, June 4, **Virgil Bogue**, Albion, N. Y.

Lachnosterna? fusca Froh., May beetle, larvae attacking roots of seedling pines, Aug. 19, **C. R. Pettis**, Lake Clear Junction, N. Y. Same, larvae on roots of evergreens, Aug. 27, **E. S. Woodruff**, Wawbeek, N. Y.

Plesiocis cribrum? Casey, adult on Polyporus on spruce, May 21, from Woburn, Mass. **C. H. Peck**, Albany, N. Y.

Acoptus suturalis Lec.; Piazurus oculatus Say; Conotrachelus anaglypticus Say; Iphthimus opacus Lec.; Oncideres cingulata Say; Dorcus parallelus Say; Corymbites hamatus Say; Geopinus incrassatus Dej.; Dicaelus dilatatus Say; Notiophilus sibiricus Mots.; Calosoma externum Say; Carabus serratus Say; Jan. 21, all from **R. F. Pearsall**, Brooklyn, N. Y.

Charles P. Alexander, Gloversville, N. Y. has contributed a number of species, some extremely desirable, in return for numerous identifications.

Diptera

Olfersia americana Leach, adult on barred owl, Oct. 25, **D. W. Alcott**, East Greenbush, N. Y.

Agromyza aeneiventris Fall., larvae, Nov. 11, **Miss C. H. Clarke**, Boston, Mass.

Trypeta bigeloviae Ckll., galls, June 24, from Florissant, Col. **T. D. A. Cockerell**, Boulder, Col.

A number of Cecidomyiid galls, **L. H. Joutel**, New York, N. Y.

A number of Cecidomyiidae, mostly bred species, **Dr M. T. Thompson,** lately deceased, formerly of Clark University, Worcester, Mass.

Cecidomyiid galls taken mostly in the vicinity of Magnolia, Mass., a few near Boston, **Miss Cora H. Clarke,** Boston, Mass.

Numerous Cecidomyiidae, **Owen Bryant,** Cohasset, Mass.

Cecidomyiid galls, mostly from the vicinity of Washington, **Miss Evelyn G. Mitchell,** Washington, D. C.

Cecidomyiidae from Kansas and Texas, **E. S. Tucker,** Plano, Tex.

Cecidomyiid galls and adults, **Prof. T. D. A. Cockerell,** Boulder, Col.

Several Cecidomyiid galls, **Dr James Fletcher,** Central Experimental Farms, Ottawa, Can.

Numerous Cecidomyiid galls, **Prof. T. D. Jarvis,** Ontario Agricultural College, Guelph, Ont.

A number of Cecidomyiid galls, **T. N. Willing,** Regina, Sask., N. W. T.

A number of Cecidomyiid galls and bred adults, **Norman Criddle,** Treesbank, Manitoba, Can.

Cecidomyia verrucicola O. S., linden leaf gall, galls on linden or basswood, Nov. 14, **J. Howell,** Highland Falls, N. Y.

Asphondylia conspicua O. S., galls and larvae on Rudbeckia laciniata, Aug. 18, **W. S. Fisher,** High Spire, Pa.

Neocerata rhodophaga Coq., adult and larvae, Dec. 8, **Prof. S. A. Forbes,** Urbana, Ill.

Taeniorhynchus perturbans Walk., adults, July 30; Eucorethra underwoodi Undw., larvae, Aug. 28, **E. Channing Stowell,** Dublin, N. H.

Culex pipiens Linn., house mosquito, adults, Sept. 23; Culicada sollicitans Walk., salt marsh mosquito, adults, Aug. 3, **D. T. Marshall,** Hollis, L. I., N. Y.

Tipulidae, several species; Pediscia albivitta Walk.; Xylota vecors O. S., Jan. 21, **R. F. Pearsall,** Brooklyn, N. Y.

Lepidoptera

Hill Collection

This is an exceptionally valuable addition to the State collections, consisting of some 10,000 specimens, representing approximately 3000 species. It is in excellent condition and was donated by Erastus D. Hill, Carrie J. Hill Van Vleck and William W. Hill, heirs of the late William W. Hill of Albany, N. Y. The catalogue of this collection is given in the appendix.

Attacus atlas Linn., adult, Sept. 17, **A. J. Booth,** Manila, P. I.

Anisota rubicunda Fabr., green striped maple worm, on maple, Aug. 12; Heterocampa guttivitta Walk., on maple, Aug. 12, **F. J. Greene,** Centre Berlin, N. Y.; the same, Aug. 22, **W. A. Stearns,** Centre Berlin, N. Y.

Epizeuxis denticulalis Harv., adult, July 31, **Mrs Alex. Hiland Hill,** Palenville, N. Y.

Ennomos subsignarius Hübn., snow-white linden moth, adults, Sept. 9, **J. M. Chew,** Newburgh, N. Y.

Leucobrephos brephoides Walk., adult, April, from St Lawrence county, **Dr T. P. Bailey**, Albany, N. Y.

Phobetron pithecium Abb. & Sm., hag moth caterpillar, larva on maple, Sept. 17, **W. E. Lackay**, Rensselaer, N. Y.

Zeuzera pyrina Fabr., leopard moth, on apple, Oct. 30, **S. B. Huested**, Blauvelt, N. Y.

Eucosma scudderiana Clem., larva on solidago, Feb. 27, **C. P. Alexander**, Gloversville, N. Y.

Ancylus nubeculana Clem., apple leaf folder, larvae on apple, Sept. 17, **C. E. Eldridge**, Leon, N. Y.

Mompha brevivittella Clem. and M. eloisella Clem., adults on Oenothera grandiflora, Oct. 16, **Miss A. A. Knox**, New York, N. Y.

Philopsia nivigerata Walk.; Euchoeca exhumata Pears. co. typ.; Mesoleuca immanata Haw.; Petrophora fluctuata Linn.; Orthofidonia exornata Walk.; Sicya macularia Harr.; Therina endropiaria Walk.; Plagodis serinaria H-S; P. phlogosaria Guen., Jan. 21, from Indian valley, Catskill mountains; all from **R. F. Pearsall**, Brooklyn, N. Y.

Hemiptera

Phylloxera caryaecaulis Fitch, hickory gall aphid, galls on hickory, May 27, **Mrs Milton Barger**, St Lawrence county, N. Y.

Empoasca mali LeB., apple leaf hopper, adult on apple, July 1, **C. W. Hagen**, Sparrowbush, N. Y.

Myzus cerasi Fabr., cherry aphis, adults on cherry, July 12, **G. S. Kidder**, Port Henry, N. Y.

Nectarophora pisi Kalt., pea aphid, adults on peas, July 13, **F. E. Guyett**, Rensselaer, N. Y.

Chermes pinicorticis Fitch, pine bark aphis on pine, Apr. 30, **C. D. Howe**, Pisgah Forest, N. C.

Phoenicococcus marlatti Ckll., on date palm, Mar. 30, from Tempe, Ariz.; **Prof. T. D. A. Cockerell**, Boulder, Col.

Aspidiotus forbesi John., cherry scale, adults on basswood, Apr. 25, **Dr James Fletcher**, Central Experimental Farms, Ottawa, Can.

A. ostreaeformis Curtis, European fruit scale, adults and young on plum, May 8, **R. Wohlers**, Williamsville, N. Y.

A. perniciosus Comst., San José scale on apple, Apr. 15, **N. J. Courtney**, Cornwall-on-Hudson, N. Y. Same, adults on currant, May 30, **D. D. Stone**, Oswego, N. Y.

Aulacaspis rosae Bouché, rose scale, adults and larvae on raspberry, Mar. 29, **C. H. Peck**, Albany, N. Y.

Chionaspis pinifoliae Fitch, pine leaf scale, eggs on pine, Nov. 9, **Isaac Hicks & Son**, Westbury Station, N. Y.

Gossyparia spuria Mod., elm bark louse, females on elm, June 15, **Mrs Douglas Merritt**, Rhinebeck, N. Y.

Orthoptera

Nyctobora holosericia Klug., giant cockroach, adult, July 1, from Albany, N. Y. **C. E. Fairman**, Lyndonville, N. Y.

Mallophaga

Docophorus syrnii Pack.?, adult on barred owl, Oct. 25, **D. W. Alcott**, East Greenbush, N. Y.

Docophrus syrnii? Pack. on barred owl, Nov. 13; Haematopinus antennatus ? Osb. on gray squirrel, Nov. 8; Lipeurus baculus Nitzsch on pigeon, Nov. 4; Lipeurus sp. on Gadwall duck, Nov. 4; Goniocotes compar Nitzsch on pigeon, Nov. 4; Trinoton luridum Nitzsch on Gadwall, Oct. 30; same, on duck, Nov. 8; same, Burrow's golden-eye; all from **G. H. Chadwick.**

Corrodentia

Atropos divinatoria Fabr., book louse, adult, Oct. 30, **Emil Voelckel**, Wakefield, New York, N. Y.

Psocus venosus Burm., adult on decayed vegetable matter, Aug. 24, from Washington, Conn. **Mrs Edwin H. Mairs**, Irvington-on-Hudson, N. Y.

EXCHANGE

Diptera

Johnson, Prof. **C. W.**, Boston, Mass. Neaspilota achilleae Johns., N. albidipennis Loew, N. vernoniae Loew, Trypeta palposa Loew, Stenomyia tenuis Loew, Chaetopsis apicalis Johns., Tetanops luridipennis Loew, Melieria obscuricornis Loew, Rivellia brevifasciata Johns., R. quadrifasciata Macq., Thelaira leucozona Panz., Paraprosena apicalis Desv., Echinomyia florum Walk., Opsidia gonioides Coq., Chaetoplagia atripennis Coq., Sturmia nigrita Town., Epigrymyia polita Town., Actia pilipennis Fall., Trichopoda plumipes Fabr., Alophora aeneoventris Will., Hydrophorus eldoradensis Wheeler, H. viridiflos Walk., Neurigona lateralis Say, Agonosoma unifasciatum Say (bicolor Loew), Psilopodinus comatus Loew, Mallophora orcina Wied., Erax maculatus Macq. (= lateralis Macq.), Laphria canis Will., L. sericea Say, Atomosia puella Wied., A. sayii Johns., Cerotainia macrocera Say, Nicocles pictus Loew, Deromyia platyptera Loew, Stichopogon argenteus Say, Holopogon guttula Wied., Holcocephala calva Loew, Lasiopogon terricola Johns., Cyrtopogon lutatius Walk., Psilocurus nudiusculus Loew, Laphystia sexfasciata Say, Leptogaster annulatus Say, L. pictipes Loew, Geron calvus Loew, G. sigma Coq., Systoechus solitus Walk., Anthrax ceyx Loew, A. edititia Say, A. lucifer Fabr., Exoprosopa eremita O. S., Tabanus fuscopunctatus Macq., T. recedens Walk., T. sparus Whitney, Chrysops nigrilimbo Whitney.

Melander, Prof. **A. L.**, Pullman, Wash. Caenia spinosa Loew, Parydra quadrituberculata Loew, P. limpidipennis

Loew, Hydrellia hypoleuca Loew, Paralimna appendiculata Loew, Tephritis variabilis Doane, T. finalis Loew, Ensina humilis Loew, Spilographa diffusa Snow, Sepedon armipes Loew, Tetanocera plumosa Loew, T. pallida Loew, Sciomyza pubera Loew, S. nana Fall., S. humilis Loew, Criorhina scitula Will., Xylota flavitibia Bigot, Eristalis temporalis Thom., E. occidentalis Will., E. bastardii Macq., Volucella esuriens Fabr., Mesogramma boscii Macq., Syrphus diversipes Macq., Platychirus chaetopodus Will., Chrysogaster stigmata Will., C. lata Loew, Chrysotoxum derivatum Walk.

Orthoptera

Britton, Dr **W. E.**, New Haven, Conn. Spharagemon bolii Scud., S. saxatile Morse, Psinidia fenestralis Serv., Scirtetica marmorata Harr., Paroxya floridana Thom., Orphulella speciosa Scud., O. pelidna Burm.

Appendix A

LIST OF THE WILLIAM W. HILL COLLECTION OF LEPIDOPTERA

This extremely valuable addition to the State collections was received through the generosity of Erastus D. Hill, Carrie J. Hill Van Vleck and William W. Hill, heirs of the late William W. Hill, who desired that the father's work should be maintained as a permanent memorial of his labors in entomology. This collection, consisting of some 10,000 species and representing over 3000 species, is in excellent condition. The Nymphalidae, Lycaenidae, Hesperidae, Sphingidae and Noctuidae are particularly well represented. The condition of Mr Hill's collection, and the manuscript catalogue of the same, bears evidence of extreme care.

Mr Hill published privately a *List of Lepidoptera Captured during 1875 and 1876 in the Vicinity of Albany and in the Adirondack Mountains of New York* as a small folder, and the late Dr J. A. Lintner[1] gave several more extended lists with dates of the Lepidoptera taken by Mr Hill in the Adirondack region.

It is most fitting in this connection that some further record be given of Mr Hill's work and the following notice[2] by Dr J. B. Smith, now State Entomologist of New Jersey gives a sympathetic account of his life:

At Elizabethtown, Essex county, N. Y., on January 28th, 1888, died William W. Hill of Albany, N. Y. This news will sadden all who in any way have known Mr Hill during his lifetime, and among entomologists there are few who do not know him or his work.

Mr Hill was born September 19th, 1833, at Pittsfield, Mass., but removed to Albany early in life, and entered the business house of Nathaniel Wright, dealer in saddler's hardware, at the age of fifteen. At the age of twenty he became a partner in the firm of Nathaniel Wright & Co., and on the death of the senior member of the firm, the business was continued under the firm name of

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[1] 1878 Ent. Contributions, 4:29–42.
1880 Top. Sur. Adirondack Region N. Y. 7th Rept, p. 375–400.
1891 State Land Sur. Rep't, p. 191–220.

[2] 1888 Smith, J. B. Entomologica Americana, 3:235–36.

Woodward & Hill, of which firm he remained an active member up to the time of his death.

On April 9th, 1855, he married Miss Jane Woodward of Albany who survives him. He also leaves surviving him three sons and one daughter. Mr Hill had a common school education; but continued his studies after entering business and was an exceedingly well informed man and agreeable companion. Always fond of outdoor life and an admirer of nature, he was an ardent fisherman and of late years spent a part of each summer in the North Woods or in the Adirondacks — combining this sport with his study of nature.

For many years he was more especially interested in botany and made large collections of plants. In 1875 he became more especially interested in insects, and collected persistently, carefully and systematically — with what success all Lepidopterists know. Though more particularly a Lepidopterist he collected also in other orders, to obtain a representation of local species. With Messrs Bailey, Lintner and Meske he made excursions in the vicinity of Albany and finally Centre [now Karner] was hit upon, as an extraordinarily productive locality and here collecting was carried on with such vim and persistency that the place became known as "Butterfly station." Enormous quantities of "sugar" were prepared and used, and thousands of moths paid the penalty. During his visits to the Adirondacks Mr Hill not only sugared persistently, but every available room was lit up and windows were left open to attract the unwary night flyers. In an unexplored field like the Adirondacks the result was most gratifying, and many previously unknown forms were discovered — the types of which are all in his collection. With such a quantity of material, exchanging was very productive and the collection rapidly increased. It was his boast that he never bought an insect, yet the collection contains rarities from all sources, the products of exchanges. He was extremely systematic in the arrangement and care of his collection, every species bearing a number — or rather two numbers — one sex an even, the other an odd number. Every species was registered, and the duplicates were all noted, so that it was only necessary to refer to the proper book and the exact number of specimens on hand was at once apparent. In addition to this he was very careful in labeling his insects, every specimen containing the exact locality, date of capture and whether at light or at sugar. The collection is therefore valuable, not only as an accumulation of material, but as an accumulation of facts, of great value in fixing dates, distribution and number of broods. The work required for all this was of course enormous, and can be appreciated only by those who have attempted anything similar.

Mr Hill was not a describer, his only contributions to the literature being in the line of faunal lists in which dates and localities were carefully noted; but though not a writer, he was a careful

observer, and his intention was, when sufficient material was accumulated to study some of the Heterocerous families systematically. This intention was unhappily prostrated by his untimely death. In September last he began to break down, and his physicians decided that the trouble was consumption. His death was quite unexpected and an autopsy revealed a cancer on the lungs as the true ailment. His death is a positive loss to entomology, removing from our midst an active worker whom it will be difficult to replace. For the reasons stated his collection is peculiarly valuable, and it is to be hoped that it will not be lost. No testamentary disposition was made, but his expressed wish was that it should be disposed of in its entirety. The National Museum would be an excellent and appropriate place for it.

Mr Hill was president of the Albany Fly-Casters Association; chairman of the executive committee of Eastern New York Fish and Game Protective Association; life member of the Albany Young Men's Association; member of the Albany Institute; of the Old Guard, Albany Zouave Cadets; Masters Lodge F. & A. M., and a vestryman of St Paul's Episcopal Church. None of his children have inherited his taste for entomology.

An attempt has been made in the following list to give the synonymy and arrangement of Dyar's list. This has been comparatively easy so far as our native forms are concerned. The presence of numerous exotic forms from widely separated parts of the world increased greatly the labor of making the list and interpolating them in their proper places. It is hoped, however, that no serious errors have been committed. This list has been prepared largely by assistants in this office, assistant D. B. Young being mostly responsible for the synonymy and arrangement. The names in parenthesis are those used by Mr Hill. The localities from which the specimens came are also indicated.

Parnassiidae

Parnassius clodius *Mene.* Kansas
P. smintheus *Doub.* Kansas
P. smintheus *var.* behrii *Edw.* Colorado
P. delius *Esp.* (phoebus *Fabr.*). Europe
P. apollo *Linn.* Europe
P. apollo *var.* hesebolus *Nordm.* Europe
P. mnemosyne *Linn.* Europe
P. stubbendorfii *Mene.* Altai mts
Eurycus cressida *Fabr.* New South Wales
Thais cerisyi *Godt.* Asia
T. polyxena *Schiff.* Hungary
T. polyxena *var.* cassandra *Hübn* Europe
T. rumina *Linn. var.* medesicaste *Ili* Savoy
Doritis apollinus *Hbst.* Europe
Callosune eupompe *Klug.* Abyssinia

Papilionidae

Iphidicles (Papilio) ajax *Linn.* Atlantic States
I. ajax *var.* telamonides *Feld.* Ohio
I. ajax *var.* marcellus *Boisd. & Lec.* Ohio
Papilio daunus *Boisd.* Arizona
P. eurymedon *Boisd.* California
P. rutulus *Boisd.* California
P. rutulus *Boisd.* *var.* arizonensis. Arizona
P. glaucus *Linn.* *var.* turnus *Linn.* New York, Ohio
P. palamedes *Dru.* Florida
P. troilus *Linn.* United States
P. thoas *Linn.* Brazil, Ohio, Illinois
P. thoas *var.* cinyras *Mene.* Amazon river
P. zolicaon *Boisd.* Pacific States, Rocky mts
P. indra *Reak.* California
P. polyxenes *Fabr.* (asterius Cram.). United States
P. andraemon *Hübn.* Cuba
P. echelus *Hbst.* Bogota
P. dardanus *Fab.* Rio de Janeiro
P. androgeos *Cram.* (polycaon *Cram.*). Amazon river
P. perrhebus *Boisd.* Paraguay
P. arcas *Cram.* *var.* zenares *Feld.* (erithalion *Koll.*). Bogota
P. pausanias *Hew.* Brazil
P. sesostris *Cram.* Bogota
P. vertumnus *Cram.* Bogota
P. vertumnus *var.* cutora *Gray.* Bogota
P. vertumnus *var.* alyattis *Feld.* Bogota
P. americus *Koll.* Bogota
P. thyastes *Dru.* Peru
P. calliste *Bates.* Amazon river
P. protesilaus *Linn.* Bogota
P. protesilaus *var.* telesilaus *Feld.* Bogota
P. dolicaon *Cram.* Venezuela
P. columbus *Hew.* Bogota
P. lycimenes *Boisd.* South America
P. nephalion *Godt.* South America
P. anchises *Linn.* Brazil
P. podalirius *Linn.* Europe
P. podalirius *var.* feisthamelii *Dup.* Europe
P. alexanor *Esp.* Europe
P. machaon *Linn.* Europe
P. machaon *var.* mandcheurie *Linn.* China
P. polytes *Linn.* China
P. eritheonius *Cram.* China
P. xuthus *Linn.* China
P. clytia *Linn.* *var.* dissimilis *Linn.* China
P. aristolochiae *Fabr.* (diphilus *Esp.*). Ceylon
P. hector *Linn.* Asia
P. rhetenor *Westw.* India
P. paris *Linn.* Himalaya
P. aristolochiae *Fabr.* (diphilus *Esp.*). Ceylon
P. eurypylus *Linn.* Asia
P. eurypylus *Linn.* *var.* lycaon *Westw.* New South Wales
P. (aegeus *Don.*). Queensland
P. sarpedon *Linn.* Queensland
P. anactus *Macl.* Queensland
P. capaneus *Westw.* Queensland
P. polydorus *Linn.* Australia
P. priamus *Linn.* *var.* richmondia *Gray.* Australia
P. pompeus *Cram.* *var.* minos *Cram.* Sumatra
P. demoleus *Linn.* Africa
P. severus *Cram.* Madagascar
P. policenes *Cram.* Africa
P. cyproeafile *Butl.* Africa
P. zalmoxis *Hew.* Africa
P. merope *Cram.* West Africa
P. nireus *Linn.* Zanzibar
Iliades (Papilio) agenor *Linn.* China
Zetides (Papilio) agamemnon *Linn.* China
Laertias (Papilio) philenor *Linn.* New York
Ithobalus (Papilio) polydamas *Linn.* Paraguay

Pieridae

Archonias philoscia *Feld.* Bogota
A. sisamnus *Fabr.* New Grenada
Dismorphia nemesis *Latr.* South America
D. medora *Doubl.* Brazil
D. eumelia *Cram.* Brazil
Hesperocharis marchalii *Guer.* Peru
Neophasia menapia *Feld.* California
Tachyris libythea *Fabr.* Ceylon
T. enarete *Boisd.* China
T. ega *Boisd.* New South Wales
Daptonoura lycimnia *Cram.* *var.* aelia *Feld.* Peru
D. ilaire *Godt.* Brazil
Delias descombesi *Boisd.* India
D. nigrina *Fabr.* Philippines
D. hierte *Hübn.* China
D. eucharis *Dru.* India
D. hyparete *Linn.* Australia
D. agostina *Hew.* India
Prioneris autothisbe *Hübn.* Java
P. clemanthee *Doubl.* India
Perrhybris pyrrha *Fabr.* Brazil
P. demophile *Linn.* South America
P. phaloe *Godt.* Brazil
Eronia cleodora *Hübn.* Abyssinia
Pontia (Pieris) monuste *Linn.* Florida
P. (Pieris) beckeri *Edw.* Nevada
P. (Pieris) sisymbri *Boisd.* California
P. (Pieris) occidentalis *Reak.* California
P. (Pieris) protodice *Boisd.* *var.* vernalis *Edw.* Kansas
P. (Pieris) napi *Linn.* Europe, California
P. napi *var.* napaeae *Esp.* Europe
P. napi *var.* bryoniae *Och.* Europe
P. napi *var.* virginiensis *Edw.* Ontario
P. napi *var.* oleracea *Harr.* New York
P. napi *var.* pallida *Scudd.* California
P. (Pieris) rapae *Linn.* Europe, United States
P. rapae *var.* orientalis *Fabr.* Asia
Pieris autodice *Hübn.* Brazil
P. callidice *Esp.* Europe
P. mesentina *Cram.* India
P. elodia *Boisd.* Mexico
P. monuste *Linn.* *var.* orseis *Godt.* Brazil
P. monuste *Linn.* *var.* albusta *Sepp.* Surinam
P. pylotis *Godt.* Bogota
P. buniae *Hübn.* Brazil
P. menada *Boisd.* Paraguay
P. brassicae *Linn.* Europe
P. daplidice *Linn.* Europe
P. daplidice *var.* bellidice *Linn.* Europe
P. nerissa *Fabr.* *var.* phryne *Fabr.* Ceylon
P. teutonia *Fabr.* New South Wales, Australia
P. java *Sparrm.* Queensland
Aporia (Pieris) crataegi *Linn.* Europe
Nathalis iole *Boisd.* Kansas
N. plauta *Doubl.* Bogota
Zegris eupheme *Esp.* Russia
Leptidia (Leucophasia) sinapis *Linn.* Europe
Synchloe (Anthocharis) creusa *Doubl. & Hew.* California
S. (Zegris) olympia *Edw.* Arizona
S. (Anthocharis) ausonides *Boisd.* Colorado
S. (Anthocharis) ausonides *var.* coloradensis *Hy. Edw.* Colorado
S. (Anthocharis) lanceolata *Boisd.* California
S. (Anthocharis) cethura *Feld.* California
S. (Anthocharis) genutia *Fabr.* Georgia
S. (Anthocharis) sara *Boisd.* California
S. (Anthocharis) reakirtii *Edw.* Oregon
Euchloe (Anthocharis) ansonia *Hübn.* *var.* belia *Cram.* South Africa, Spain

Euchloe (Anthocharis) cardamines *Linn.* Europe
E. (Anthocharis) gruneri *Herr.-Schaef.* Asia
E. (Anthocharis) tagis *Hübn. var.* bellizina *Boisd.* France
E. (Anthocharis) euphenoides *Stegr.* Europe
E. (Anthocharis) belemia *Esp.* Europe
E. (Anthocharis) belemia *var.* glauce *Hübn.* Spain
Idmais fausta *Oliv.* India
Callidryas (Catopsilia) philea *Linn.* Bogota
C. eubule *Linn.* Georgia, Texas
Aphrissa (Catopsilia) statira *Cram.* Brazil
Phoebis (Catopsilia cipris *Cram.*) argante *Fabr.* Bolivia
P. (Catopsilia) agarithe *Boisd.* Bogota
Catopsilia trite *Linn.* Central America
C. menippe *Hübn.* Bogota
C. crocale *Cram.* China
C. florella *Fabr.* Africa
C. pomona *Fabr.* Australia
C. pyranthe *Linn.* New South Wales
Gonepteryx maesula *Fabr.* Brazil
G. rhamni *Linn.* Russia
G. (Rhodocera) cleopatra *Linn.* Dalmatia
Kricogonia lyside *Godt.* Texas, West Indies
K. fantasia *Butl.* Texas
Zerene (Colias) eurydice *Boisd.* California
Z. (Colias) caesonia *Stoll.* Wisconsin, Texas, Colorado
Eurymus (Colias) meadii *Edw.* Colorado
E. (Colias) eurytheme *Boisd.* Texas, California
E. eurytheme *var.* ariadne *Edw.* Arizona
E. (Colias hagenii *Edw.*) *var.* eriphyle *Edw.* Wyoming, British Columbia
E. (Colias) philodice *Godt.* New York
E. (Colias chrysomelas *Edw.*) occidentalis *Scudd.* California
E. (Colias) christina *Edw.* British America
E. (Colias) alexandra *Edw.* Colorado
E. alexandra *var.* edwardsii *Behr.* Colorado
E. (Colias) scudderi *Reak.* Rocky mts
E. (Colias) pelidne *Boisd.* Labrador
E. (Colias) nastes *Boisd.* Labrador
E. (Colias) behrii *Edw.* California
Hebemcia glaucippe *Linn. var.* celebensis *Wall.* Celebes
Colias pyrrothea *Hübn.* Chili
C. dimera *Doubl.* Bogota
C. edusa *Fabr.* (croceus *Four.*). Europe
C. phicomone *Esp.* Europe
C. hyale *Linn.* Europe
C. hyale *var.* sareptensis *Staud.* Europe
C. hecla *Lef.* Lapland
C. erate *Esp.* Russia
C. palaeno *Linn.* Russia
C. chrysotheme *Esp.* Europe, Siberia
C. fieldii *Menc.* Himalaya mts
C. myrmidone *Esp.* Europe
C. electra *Linn.* Cape Good Hope
Pyrisita (Terias) gundlachia *Pocy.* Texas, Cuba
P. (Terias) proterpia *Fabr.* Texas, Brazil
P. (Terias mexicana *Boisd.* California, Kansas
Eurema (Terias) nicippe *Cram.* Nebraska, Kansas, New York
E. (Terias lisa *Boisd.* & *Lec.*) euterpe *Menc.* Florida, Texas
E. euterpe *Menc var.* alba *Streck.* (Colias eurytheme *Boisd. var.* alba *Streck.*). California
E. (Terias) delia *Cram.* Florida
E. (Terias) elathea *Cram.*
E. (Terias) jucunda *Boisd. & Lec.* Florida
E. bulaea *Boisd.* Cuba

Eurema palmyra *Poey.* Cuba
E. (Terias) aequatorialis *Feld.* Brazil
E. gangamela *Feld.* Peru
E. (Terias) nice *Cram.* South America
E. (Terias) stygma *Boisd.* *var.* stygmula *Boisd.* Central America
E. (Terias) agave *Cram.* South America
E. hecabe *Linn.* China
E. (Terias) brigitta *Cram.* *var.* drona *Horsf.* India
E. brigitta *var.* pulchella *Boisd.* Africa
E. mandarina *De L.* Japan

Nymphalidae

Colaenis dido *Linn.* Brazil
C. phaerusa *Linn.* Brazil
C. julia *Fabr.* Brazil
C. julia *var.* delila *Fabr.* Brazil
Agraulis (Dione) vanillae *Linn.* Florida
Dione juno *Cram.* Bogota
D. moneta *Hübn.* Bolivia
Cethosia cyane *Dru.* Cochin China
Clothilda numida *Hübn.* Cuba
Cirrochroa aoris *Doubl.* India
Pyrameis (Cynthia) arsinoe *Cram.* Australia
Euptoieta claudia *Cram.* Kansas, Texas, Tennessee
E. hegesia *Cram.* Brazil
Semnopsyche (Argynnis) diana *Cram.* Georgia
Speyeria (Argynnis) idalia *Dru.* United States
Argynnis nokomis *Edw.* Arizona
A. leto *Behr.* Western United States
A. cybele *Fabr.* United States
A. aphrodite *Fabr.* United States
A. aphrodite *Fabr.* *var.* alcestis *Edw.* United States
A. atlantis *Edw.* United States
A. electa *Edw.* Utah, Colorado
A. hesperis *Edw.* Colorado
A. bremnerii *Edw.* Pacific States
A. zerene *Boisd.* California
A. monticola *Behr.* California
A. monticola *Behr.* *var.* purpurascens *Hy. Edw.* California
A. halcyone *Edw.* Rocky mts
A. coronis *Behr.* California
A. callippe *Boisd.* California
A. nevadensis *Edw.* Nevada
A. edwardsii *Reak.* Colorado
A. chitone *Edw.* Nevada
A. liliana *Hy. Edw.* California
A. rupestris *Behr.* *var.* irene *Boisd.* California
A. adiaste *Behr.* (adiante *Boisd.*). California
A. eurynome *Edw.* Colorado, Wisconsin
A. eurynome *Edw.* *var.* arge *Streck.* California
A. montivaga *Behr.*
A. (montivaga) aphirape *Hübn.* Europe
A. (montivaga) aphirape *var.* triclaris *Hübn.* Europe, Labrador
A. (montivaga) aphirape *var.* baetica *Rbr.* Europe
A. selene *Schiff.* Europe
A. euphrosyne *Linn.* Europe
A. pales *Schiff.* Europe
A. pales *var.* lapponica *Stegr.* Europe
A. thore *Hübn.* Europe
A. dia *Linn.* Hungary
A. amathusia *Esp.* Germany
A. hecate *Esp.* Europe
A. ino *Rott.* Russia, Europe
A. daphne *Schiff.* Europe
A. lathonia *Linn.* Europe
A. aglaja *Linn.* Europe
A. niobe *Linn.* Europe
A. niobe *var.* eris *Meig.* Europe
A. adippe *Linn.* Europe
A. sagana *Doubl.* Amoorland
A. paphia *Linn.* Europe
A. pandora *Schiff.* Europe
A. niphe *Linn.* Java
Brenthis myrina *Cram.* United States

Brenthis (Argynnis) helena *Edw.* Colorado
B. (Argynnis) chariclea *Schneider.* Europe
B. (Argynnis) polaris *Boisd.* Norway, Labrador
B. (Argynnis) frigga *Thunb.* Europe
B. (Argynnis) bellona *Fabr.* New York, Ohio
B. (Argynnis) epithore *Boisd.* Nevada, Oregon
Apatura (Hypolimnas) misippus *Linn.* Queensland
Hypolimnas bolina *Linn.* (lasinassa *Cram.*). China
H. salmacis *Dru.* Madagascar
H. alimena *Linn.* Queensland
H. anthedon *Doubl.* Cape Good Hope
Euphydryas (Melitaea) phaeton *Dru.* New York
Lemonias (Melitaea) cooperi *Behr.* Colorado, Washington
L. (Melitaea) chalcedon *Doubl.* California
L. (Melitaea) colon *Edw.* Washington
L. (Melitaea) anicia *Doubl. & Hew.* Nevada
L. (Melitaea) nubigena *Behr.* Colorado
L. (Melitaea) baroni *Hy. Edw.* Nevada
L. (Melitaea) rubicunda *Hy. Edw.* Oregon
L. (Melitaea) editha *Boisd.* California
L. (Melitaea) acastus *Edw.* Arizona
L. (Melitaea) palla *Boisd.* California
L. (Melitaea) whitneyii *Behr.* Colorado
L. (Melitaea) hoffmanni *Behr.* California
L. (Melitaea) gabbii *Behr.* California
Cinclidia (Melitaea) harrisii *Scudd.* Maine
C. (Melitaea) perse *Edw.* Arizona
C. (Melitaea) chara *Edw.* Arizona
Thessalia (Melitaea) leanira *Boisd.* California
T. theona *Mene.* (Melitaea fulvia *Edw.*). Rio Grande
Schoenis (Melitaea) minuta *Edw.* Colorado
S. (Melitaea) nympha *Edw.* Arizona
Melitaea cynthia *Hübn.* Schwerin
M. maturna *Linn.* Europe
M. aurinia *Rott.* Europe
M. aurinia *var.* sareptana *Stegr.* Siberia
M. aurinia *var.* merope *Prun.* Schwerin, Dalmatia
M. desfontainii *Godt.* Spain, Russia
M. desfontainii *Godt. var.* baetica *Rbr.* Europe
M. cinxia *Linn.* Europe
M. aetherie *Hübn.* Europe
M. didyma *Esp.* Europe
M. trivia *Schiff.* Europe
M. trivia *var.* fascelis *Esp.* Europe
M. athalia *Rott.* Europe
M. aurelia *Nick.* Thuringia
M. parthenie *Bkh.* Europe
M. parthenie *var.* varia *Meyer.* Europe
M. dictynna *Esp.* Europe
M. asteria *Frr.* Schwerin, Hungary
Charidryas (Phyciodes) nycteis *Doubl. & Hew.* New York
C. ismeria *Boisd.* (Phyciodes carlota *Reak.*). Arizona
Phyciodes phaon *Edw.* Florida
P. tharos *Drury* (*var.* marcia *Edw.*). Ohio, New York
P. tharos *var.* morpheus *Fabr.* New York
P. batesii *Reak.* New York
P. pratensis *Behr.* Arizona, Colorado
P. camillus *Edw.* Colorado
P. mylitta *Edw.* California
P. picta *Edw.* Colorado
P. liriope *Cram. var.* fragilis *Bates.* Brazil
P. (Eresia) eunice *Hübn.* Bogota

Anthanassa (Eresia) texana *Edw.* Texas
Chlosyne (Coatlantona) janais *Dru.* Brazil, Texas
C. lacinia *Geyer* (Synchloe adjutrix *Scudd.*). Texas, New Mexico
Coatlantona narva *Fabr.* Central America
Araschnia levana *Linn.* Europe
Mestra (Cystineura) amymone *Mene.* Texas
Polygonia (Grapta) interrogationis *Fabr.* New York
P. (Grapta) comma *Harris.* New York
P. (Grapta) comma *var.* dryas *Edw.* New York
P. (Grapta) satyrus *Edw.* New York
P. (Grapta) faunus *Edw.* New York
P. (Grapta) zephyrus *Edw.* New York
P. (Grapta) progne *Cram.* New York
P. (Grapta) c-album *Linn.* Europe
P. (Grapta) egea *Cram.* Europe
Eugonia (Vanessa) j-album *Boisd.* New York
E. (Vanessa) californica *Boisd.* California
Euvanessa (Vanessa) antiopa *Linn.* New York, Europe
Aglais milberti *Godt.* New York
Vanessa (Pyrameis) atalanta *Linn.* United States, Europe
V. huntera *Fabr.* New York
V. cardui *Linn.* United States, Europe
V. jo *Linn.* Europe
V. urticae *Linn.* Europe
V. l-album *Esp.* (Vau album *Nicev.*). Europe
V. xanthomelas *Esp.* Europe
V. polychlorus *Linn.* Europe
Pyrameis itea *Fabr.* New South Wales
P. indica *Hbst.* India
P. myrinna *Doubl.* Rio de Janeiro
Junonia clelia *Cram.* Africa
J. orithya *Linn.* New South Wales
J. genoveva *Cram.* Amazon river
J. lavinia *Cram.* Brazil
J. asterie *Linn.* China
J. laomedia *Linn.* China
J. oenone *Linn. var.* hierta *Fabr.* China
J. coenia *Hübn.* South Atlantic States
J. vellida *Fabr.* New South Wales
Salamis anacardii *Linn.* Africa
S. antilope *Feisth.* Abyssinia
Napeocles jucunda *Hübn.* Amazon river
Kallima inachis *Boisd.* India
K. rumia *Westw.* Calabar
Doleschallia bisaltide *Cram.* New Guinea
Anartia jatrophae *Linn.* Texas, Brazil
A. lytrea *Godt.* Cuba
A. fatima *Fabr.* Costa Rica
A. amalthea *Linn.* Bogota
Victorina steneles *Linn.* Central America
V. epaphus *Latr.* Mexico
V. sulpitia *Cram.* Guiana
Hypanartia dione *Latr.* Central America
H. delius *Dru.* West Africa
H. zabulina *Godt.* Europe
Didonis bibilis *Fabr.* Amazon river
Pyrrhogyra typhoeus *Feld.* Brazil
Ergolio ariadne *Linn.* China
Cybdelis mnasylus *Doubl. & Hew.* South America
Cyclogramma pandama *Doubl.* Brazil
Temenis laothoe *Cram.* Brazil
T. laothoe *var.* ariadne *Cram.* Brazil
Nica canthara *Doubl.* Panama
Dynamine agacles *Dalm.* Brazil
D. myrrhina *Doubl.* Peru
D. rostverta *Cram.* Central America
Eunica monima *Cram.* (modesta *Bates*). Texas
E. clytia *Hew.* Brazil
E. veronica *Bates.* Bogota, Peru
E. pomona *Feld.* Bolivia

Diaethria (Callicore) clymena *Cram.* Peru
Amphichlora (Ageronia) fornax *Hübn.* Central America
A. (Ageronia) feronia *Linn.* Brazil
Ageronia chloe *Stall.* Central America
A. belladonna *Bates.* Brazil
A. amphinome *Linn.* Brazil
A. arethusa *Cram.* Central America
A. velutina *Bates.* Bogota
Callicore eluina *Hew.* Bogota
C. lidwina *Feld.* Peru
C. cornelia *Herr.-Schaef.* South America
Megalura berania *Hew.* Cuba
M. orsilochus *Fabr.* Brazil
M. corinna *Latr. var.* marcella *Feld.* Brazil
M. iole *Dru.* Panama
Anthena (Megalura) peleus *Sulz.* Central America
Timetes (Megalura) chiron *Fabr.* Brazil
Perisama priene *Hopff.* Peru
P. humboltii *Guer.* Peru
Catagramma peristera *Hew.* Bogota
C. hesperis *Guer.* Peru
C. *sp.* Bogota
Gynaecia dirce *Linn.* Brazil
Batesia prola *Doubl. & Hew.* Peru
B. divalis *Bates.* Bogota
B. hypochlora *Feld.* Bogota
Callizona aceste *Linn.* Brazil
Libythina cuvierii *Grtt.* Peru
Myscelia cyaniris *Doubl.* Honduras
M. orsis *Dru.* Rio de Janeiro
Catonephele acontius *Linn.* Brazil
C. sabrina *Hew.* South America
C. nyctimus *Westw.* South America
Lebadea alankara *Horsf.* India
Basilarchia (Limenitis) ursula *Godt.* Ohio
B. astyanax *Fabr. var.* arizonensis *Edw.* (Limenitis ursula *Godt.*). Arizona
B. (Limenitis) arthemis *Dru.* New York
B. (Limenitis) arthemis *var.* proserpina *Edw.* New York
B. (Limenitis) weidemeyerii *Edw.* Colorado
B. (Limenitis disippe *Godt.*) archippus *Cram.* New York
B. (Limenitis eros *Edw.*) floridensis *Streck.* Mississippi
B. (Limenitis) lorquinii *Boisd.* Pacific States
Limenitis (Adelpha) bredowii *Hübn.* Peru
L. (Adelpha) bredowii *var.* californica *Butl.* California
L. populi *Linn.* Europe
L. populi *var.* tremulea *Esp.* Russia
L. camilla *Schiff.* Europe
L. sibilla *Linn.* Europe
Adelpha iphicla *Linn.* Bogota
A. serpa *Boisd.* Amazon river
A. olynthia *Feld.* Bogota
Hestina nama *Doubl.* Himalaya mts
Neptis lucilla *Fabr.* Hungary
N. aceris *Lep.* Europe
Euphhaedra ceres *Fabr.* Calabar
E. medon *Linn.* West Africa
E. xypete *Hew.* West Africa
Cymothoe (Harma) aemilius *Doum.* Calabar
C. (Harma) theobene *Doubl.* West Africa
Apatura iris *Linn.* France, Europe
A. ilia *Schiff.* Europe
A. ilia *var.* clytie *Schiff.* Europe
A. elis *Feld.* Peru
A. lucasii *Doubl.* Brazil
A. laurentia *Godt.* Brazil
A. angelina *Feld.* Peru
A. zunilda *Godt.* Peru
A. druryi *Hübn.* Cuba
Chlorippe (Apatura) celtis *Boisd. & Lec.* Texas
C. (Apatura) leilia *Edw.* Arizona
C. (Apatura) alicia *Edw.* Florida
C. (Apatura) clyton *Boisd. & Lec.* Texas
C. (Apatura) clyton *var.* proserpina *Scudd.* Atlantic States
C. (Apatura) flora *Edw.* Florida
Coea (Aganisthos) acheronta *Fabr.* Bogota, Cuba

Historis (Aganisthos) odius *Fabr.* Bogota
Prepona pheridamas *Cram.* Guiana
P. meander *Cram.* Chili
Smyrna karwinskii *Hübn.* Mexico
Charaxes (Nymphalis) jasius *Linn.* Algeria, France
Nymphalis brutus *Cram.* West Africa
N. eudamippus *Doubl.* India
N. neanthes *Hew.* South Africa
Megistanis baeotus *Doubl. & Hew.* Bogota
M. deucalion *Feld.* Bogota
Hypna clytemnestra *Cram.* Brazil
Anaea andria *Scudd.* (Paphia troglodyta *Fabr.*). Texas
A. philumena *Doubl.* Peru
A. arginusa *Hübn.* Brazil
Siderone ide *Hübn.* Cuba

Agapetidae

Melanargia lachesis *Hübn.* Europe
M. lachesis *Hübn. var.* halimede *Mene.* China
M. galathea *Linn.* Europe
M. galathea *var.* procida *Hbst.* Europe
M. japygia *Cyr. var.* suwarovius *Hbst.* Russia
M. japygia *var.* caucasica *Nordm.* Russia
M. ines *Hffsgg.* Europe
M. syllius *Hbst.* Europe
Cercyonis (Satyrus) alope *Fabr.* Atlantic States
C. (Satyrus) alope *var.* boopis *Behr.* Pacific States
C. (Satyrus) alope *var.* nephele *Kirby.* Atlantic States
C. (Satyrus) gabbii *Edw.* Arizona
C. (Satyrus) meadii *Edw.* Colorado
C. (Satyrus) sylvestris *Edw.* California
C. (Satyrus) sylvestris *var.* charon *Edw.* Nevada
Gyrocheilus tritonia *Edw.* Arizona
Aphantopus (Satyrus) hyperantus *Linn.* Europe
Satyrus fidia *Linn.* Europe
S. statilinus *Hufn.* Asia, Europe
S. statilinus *var.* allionia *Fabr.* Europe
S. arethusa *Esp.* Europe
S. semele *Linn.* Europe
S. semele *var.* aristaeus *Bon.* Europe
S. anthe *Och.* Europe
S. briseis *Linn.* Europe
S. hermione *Linn.* Europe
S. alcyone *Schiff.* Europe
S. circe *Fabr.* Europe
S. dryas *Scop.* (phaedra *Linn.*)
S. actaea *Esp. var.* cordula *Fabr.* Europe
S. actaea *var.* bryce *Hübn.* Caucasus
Erebia tyndarus *Esp.* Germany
E. tyndarus (*var.* callias *Edw.*). Colorado
E. disa *Thunb.* Europe
E. melampus *Fuessl.* Europe
E. mnestra *Hübn.* Alps, Europe
E. arete *Fabr.* Schwerin, Germany
E. pharte *Hübn.* Europe
E. manto *Esp.* Europe
E. ceto *Hübn.* Europe
E. medusa *Fabr.* Europe
E. medusa *var.* polaris *Stegr.* Europe
E. medusa *var.* psodea *Hübn.* Europe
E. oeme *Hübn.* Europe
E. glacialis *Esp. var.* alecto *Hübn.* Europe
E. stygne *Och.* Europe
E. afer *Esp.* Russia
E. gorge *Esp.* Alps, Europe
E. goante *Esp.* Europe
E. pronoe *Esp.* Europe
E. pronoe *var.* pitho *Hübn.* Europe
E. aethiops *Esp.* Europe
E. ligea *Linn.* Europe
E. euryale *Esp.* Europe
E. epistigne *Hübn.* France
E. evias *Gcdt.* France
E. epiphron *Knoch var.* cassiope *Fabr.* Schwerin, Germany
Neominois (Satyrus) ridingsii *Edw.* Colorado

Neominois dionysius *Scudd.* Colorado
Coenonympha californica *Doubl. & Hew.* California
C. elko *Edw.* (ampelos *Edw.*). Nevada, Massachusetts
C. ochracea *Edw.* Colorado
C. typhon *Rott.* Europe
C. typhon *Rott.* (inornata *Edw.*). California
C. iphis *Schiff.* Europe
C. arcania *Linn.* Europe
C. arcania *var.* darwiniana *Stegr.* Europe
C. arcania *var.* satyrion *Esp.* France
C. amaryllis *Cram.* Europe
C. pamphilus *Linn. var.* lyllus *Esp.* Europe
C. oedippus *Fabr.* Europe
C. hero *Linn.* Europe
Triphysa phryne *Pall.* Siberia
Enodia (Debis) portlandia *Fabr.* Ohio, Atlantic States
Satyrodes (Neonympha) canthus *Linn.* New York
Oeneis (Chionobas californica *Boisd.*) nevadensis *Felder.* California, Washington
O. (Chionobas) chryxus *Doubl. & Hew.* Wisconsin, Colorado
O. jutta *Hübn.* Labrador
O. uhleri *Reak.* Colorado
O. norna *Thunb. var.* taygete *Hübn.* North Labrador
O. norna *var.* semidea *Say.* White mts
O. aello *Esp.* Europe
O. bore *Schn.* Europe
Pararge aegeria *Linn.* Europe
P. achine *Scop.* (dejanira *Linn.*). Europe
P. climene *Esp.* Russia
P. megera *Linn.* Europe
P. megera *var.* lyssa *Hübn.* Europe
P. hiera *Fabr.* Europe
P. maera *Linn.* Europe
P. maera *var.* adrasta *Hübn.* Europe
Neonympha gemma *Hübn.* Southern States
N. henshawii *Edw.* Rocky mts
N. phocion *Fabr.* Southern States
Cissia (Neonympha) eurytus *Fabr.* New York
C. (Neonympha) sosybius *Fabr.* Florida, Texas
C. (Neonympha) rubricata *Edw.* Arizona
Epinephele jurtina *Linn.* Europe
E. jurtina *Linn. var.* hispulla *Hübn.* Spain
E. ida *Esp.* Europe
E. pasiphaë *Esp.* Europe
E. lycaon *Rott.* Hungary
E. wagneri *Herr.-Schaef.* Persia
E. abeona *Don.* New South Wales
Xenica achanta *Don.* South Wales
Heteronympha merope *Fabr.* Australia
Euptychia mollina *Hübn.* Amazon river
E. libye *Linn.* Central America
E. herse *Cram.* South America
E. hesione *Sulz.* South America
E. mynceoides *Stegr.* Panama
Cithaerias andromeda *Fabr.* Brazil
Haetera hypaesia *Hew.* Bogota
Pierella nereis *Dru.* Brazil
P. lena *Linn.* Peru
P. dracontis *Hübn.* Para
Melanitis leda *Linn.* Australia

Morphinae

Thaumantis camadeva *Westw.* Himalaya mts
Morpho sulkowskyi *Koll.* Ecuador
M. menelaus *Linn.* Brazil
M. achilles *Linn. var.* helenor *Cram.* Brazil
M. achilles *var.* leonte *Hübn.* Brazil
M. achilles *var.* leonte achillaena *Hübn.* Guiana
M. achilles *var.* patroclus *Feld.* Peru
M. achilles *var.* coelestis *Butl.* Brazil
M. didius *Hopff.* Peru
M. hercules *Dalm.* Amazon river
M. laertes *Dru.* Brazil

Brassolinae

Caligo ilioneus *Cram.* Brazil
C. eurylochus *Cram.* Brazil
C. idomeneus *Linn.* Surinam
C. teucer *Linn.* Brazil

Acraeinae

Acraea andromacha *Fabr.* Australia
A. serena *Fabr.* Africa
A. vesta *Fabr.* India
A. arganice *Hew.* Natal
A. anteas *Doubl. & Hew.* Venezuela
A. diceus *Latr.* Peru

Heliconidae

Apostraphia (Heliconius) charithonia *Linn.* Florida
Heliconius melpomene *Linn.* Bogota
H. estrella *Bates.* South America
H. petiverana *Doubl.* Brazil
H. vesta *Cram.* Columbia
H. phyllis *Fabr.* Brazil
H. burneyi *Hübn.* Brazil
H. fornarina *Hew.* Costa Rica
H. leuce *Doubl.* Brazil
H. clydno *Doubl.* Brazil
H. pochinus *Salv.* Columbia
H. rhea *Cram.* Brazil, Bogota
H. apseudes *Hübn.* Amazon river
H. hermathena *Hew.* Brazil
H. erato *Linn.* Brazil
H. erato *var.* doris *Linn.* Brazil
H. neumata *Cram.* Central America
H. eucrate *Hübn.* Brazil
H. antiochus *Linn.* Bogota
Eueides aliphera *Godt.* Bogota
E. thales *Cram.* Bogota
E. lybia *Fabr.* Amazon river
E. isabella *Cram.* Amazon river

Ithomiidae

Dircenna klugii *Hübn.* Brazil, Guatemala
Hamadryas zoilus *Fabr.* Brazil
Lycorea cleobaea *Godt.* South America
L. halia *Hübn.* Brazil
L. pasinuntia *Cram.* Amazon river
Thyridia psidii *Linn.* Bogota
Aprotopos aedesia *Doubl.* Amazon river
Ceratinia vallonia *Hew.* Amazon river
Mechanitis polymnia *Linn.* Brazil
M. polymnia *var.* lysimnia *Fabr.* Brazil
Ithomia flora *Cram.* Brazil
I. sao *Hübn. var.* antisao *Bates.* Bogota
I. eurimedia *Cram.* Brazil
I. diaphanus *Dru.* South America
I. oto *Hew.* Costa Rica
Melinaea egina *Cram.* Amazon river
M. mneme *Linn.* Amazon river
M. lilis *Hew. var.* imitata *Bates.* Costa Rica
Tithorea tarracina *Hew.* Central America
T. harmonia *Cram. var.* cuaprina *Bates.* South America

Lymnadidae

Anosia (Danais erippus *Cram.*) plexippus *Linn.* Jamaica, New York, Java
A. berenice *Cram.* Texas
A. (Danais) berenice *var.* strigosa *Bates.* Mexico
Danais plexaure *Godt.* Brazil
D. albata *Zink.* Java
D. melenaus *Cram.* Celebes
D. aglea *Cram. var.* luzonensis *Feld.*
D. aglea *var.* grammica *Boisd.* Cochin China

Danais limniace *Cram.* India
D. limniace *var.* hamata *Macl.* Queensland
D. juventa *Cram.* Java
D. similis *Linn.* Malacca
D. chrysippus *Linn.* Cochin China
D. chrysippus *var.* alcippus *Cram.* Africa
D. gilippus *Cram.* Brazil
D. gilippus *var.* jamaicensis *Bates.* Jamaica
Hestia blanchardii *March.* Celebes
Ideopsis vitrea *Blanch.* Moluccas
Amauris egilaea *Cram.* Java
Euploea godartii *Luc.* Cochin China
E. core *Cram.* India
E. hyems *Butl.* Australia
E. diocletia *Hübn.* Philippine Islands
E. midamus *Linn.* China
E. eleutho *Quoy var.* helcita *Boisd.* (montrouzieri *Newm.*). Fiji Islands

Libytheidae

Hypatus (Libythea) carinenta *Cram.* Texas
Libythea celtis *Fuess.* Europe
L. motya *Boisd.* Cuba

Erycinidae

Nemeobius lucina *Linn.* Europe

Lemoniidae

Alesa amosis *Cram.* Cayenne
Eurybia nicaeus *Fabr.* Brazil
Mesosemia traga *Hew.* Para
M. croesus *Fabr.* Amazon river
Ancyluris eryxo *Saund.* Peru
A. aulestes *Cram.* Brazil
Apodemia epulus *Cram.* Brazil
Stalachtis phlegia *Cram.* Brazil
S. susanna *Fabr.* South America
S. euterpe *Linn.* Bogota
S. evelina *Butl.* Amazon river
S. striata *Guer.* Bogota
Lemonias emylius *Cram.* Guiana
L. pseudocrispus *Westw.* Brazil
Helicopis endymion *Cram.* Surinam
Nymphalidium caricae *Linn.* South America

Riodinidae

Chrysobia (Lemonias) cythera *Edw.* California
C. (Lemonias) virgulti *Behr.* California
Polystigma (Lemonias) nais *Edw.* Arizona
P. (Lemonias) palmerii *Edw.* Arizona
Emesis (Lemonias) zela *Butl. var.* cleis *Edw.* Arizona
E. lucinda *Cram.* Brazil
Calephelis caenius *Linn.* Florida

Lycaenidae

Eumaeus (Eumenia) atala *Pocy.* Florida
Habrodias (Thecla) grunus *Boisd.* California
Hypaurotis (Thecla) crysalus *Edw.* Colorado
Atlides (Thecla) halesus *Cram.* Texas
Uranotes (Thecla humuli *Harr.*) melinus *Hübn.* Florida
Thecla favonius *Sm. & Abb.* Florida
T. acadica *Edw.* Ohio
T. californica *Edw.* California
T. edwardsii *Saund.* New York
T. wittfeldii *Edw.* Florida
T. calanus *Hübn.* New York

Thecla liparops *Boisd.* (strigosa *Harr.*). New York
T. saepium *Boisd.* Pacific States
T. blenina *Hew.* (siva *Edw.*). Texas
T. erix *Cram.* Brazil
T. syncellus *Cram.* Brazil
T. marsyas *Linn.* Rio de Janeiro
T. linus *Sulz.* Surinam
T. pelion *Cram.* Brazil
T. hemon *Cram.* South America
T. pholeus *Cram.* Brazil
T. phaleros *Linn.* Brazil
T. (Lycaena) caranus *Cram.* Bogota
T. spini *Schiff.* Siberia
T. w-album *Knoch.* Europe
T. ilicis *Esp.* Europe
T. acaciae *Fabr.* Europe
T. pruni *Linn.* Europe
Mitoura (Thecla smilacis *Boisd. & Lec.*) damon *Cram.* New York
Calycopis (Thecla poeas *Hübn.*) cecrops *Fabr.* Florida
Incisalia (Thecla) augustus *Kirby.* New York
I. (Thecla) irus *Godt.* New York
I. (Thecla) niphon *Hübn.* New York
Callophrys (Thecla) dumetorium *Boisd.* California
C. rubi *Linn.* Europe
Strymon (Thecla) titus *Fabr.* New York
Zephyrus quercus *Linn.* Europe
Z. betulae *Linn.* Europe
Feniseca tarquinius *Fabr.* New York
Tharsalea (Lycaena) virginiensis *Edw.* Colorado
Gaeides (Polyommatus) xanthoides *Boisd.* California
G. (Polyommatus) dione *Scudd.* Kansas
G. (Polyommatus) gorgon *Boisd.* California
Thestor ballus *Fabr.* Europe
Chrysophanus thoe *Boisd.* Ohio, New York
C. (Polyommatus) phlaeas *Linn.* Europe
C. (Polyommatus) phlaeas *var.* eleus *Fabr.* Europe
C. (Polyommatus) alciphron *Rott.* Europe
C. (Lycaena) alciphron *var.* gordius *Sulz.* Europe
C. (Polyommatus) amphidamas *Esp.* Siberia
C. (Polyommatus) amphidamas *var.* obscura *Wernb.*
C. (Polyommatus) virgaureae *Linn.* Europe
C. (Polyommatus) thersamon *Esp.* Europe
C. (Polyommatus) caspius *Led.* Russia
C. (Polyommatus) dispar *Haw. var.* rutilus *Wernb.*
C. (Polyommatus) hippothoe *Linn.* Europe
C. (Polyommatus) dorilis *Hufn.* Europe
Epidemia (Chrysophanus) helloides *Boisd.* Colorado
E. (Polyommatus) epixanthe *Boisd. & Lec.* Maine
Heodes (Chrysophanus) hypophleas *Boisd.* New York
Chalceria (Polyommatus) rubidus *Edw.* Montana
C. (Polyommatus) rubidus *var.* sirius *Edw.* Colorado
Cupido (Lycaena) heteronea *Boisd.* Colorado
C. (Lycaena) lycea *Edw.* Colorado
C. (Lycaena daedalus *Behr.*) icarioides *Boisd.* Colorado
C. (Lycaena) saepiolus *Boisd.* Colorado
C. (Lycaena) pheres *Boisd. var.* evius *Boisd.* Mt Hood
C. (Lycaena) nyseus *Guer.* India
C. (Lycaena) cassius *Cram.* South America
Nomiades (Lycaena) antiacis *Boisd.* California
N. (Lycaena) lygdamas *Doubl.* Wisconsin, Colorado
Phaedrotes (Lycaena lorquinii *Behr.*) sagittigera *Feld.* California
Philotes (Lycaena) sonorensis *Feld.* California

Agriades (Lycaena) aquilo *Boisd.* Europe, Labrador
A. (Lycaena) rustica *Edw.* Colorado
Rusticus (Lycaena) shasta *Edw.* Colorado
R. (Lycaena) melissa *Edw.* Nevada
R. (Lycaena) scudderi *Edw.* New York
R. (Lycaena) acmon *Doubl. & Hew.* California
R. (Lycaena) anna *Edw.* California
Lycaena argiades *Pall.* Europe
L. argus *Linn.* Europe
L. sephyrus *Friv.* Russia
L. alcedo *Chrysto.* Russia
L. optilete *Knoch.* Europe
L. orion *Pall.* (battus *Hübn.*). Europe
L. orbitulus *Prun.* Europe
L. pheretes *Hübn.* (atys *Hübn.*). Europe
L. astrarche *Bgstr.* (alexis *Hübn.*) *var.* allous *Hübn.* Europe
L. eumedon *Esp.* Europe
L. amandus *Schn.* Europe
L. eros *Och.* Alps
L. eros *var.* eroides *Friv.* Russia
L. icarus *Rott.* Europe
L. icarus *var.* icarinus *Scrif.* Europe
L. hylas *Esp.* (dorylas *Hübn.*). Europe
L. bellargus *Rott.* (adonis *Hübn.*). Europe
L. hylas *Esp.* France
L. coridon *Poda.* Europe
L. coridon *var.* caucasica *Led.* Russia
L. erschoffii *Led.* Persia
L. meleager *Esp.* Europe
L. meleager *var.* steevenii *Frr.* Russia
L. admetus *Esp.* Europe
L. admetus *var.* ripartii *Frr.* Russia
L. damon *Schiff.* Europe
L. damone *Ever.* Russia
L. damone *var.* carmon *Herr.-Schaef.* (eurpilus *Frey*). Russia
L. semiargus *Rott.* (argiolus *Esp.*) (termiagus *Butl.*). Europe
L. sebrus *Boisd.* France
L. cyllarus *Rott.* Europe
L. melanops *Boisd.* France
L. jolas *Ochs.* Europe
L. alcon *Fabr.* Europe
L. euphemus *Hübn.* (diomedes *Rott.*). Europe
L. arion *Linn.* Europe
L. arcas *Rott.* Europe
Cyaniris ladon *Cram.* (Lycaena pseudargiolus *Linn.*). Illinois
C. ladon *var.* lucia *Kirby.* New York
C. ladon *var.* violacea *Edw.* Virginia
C. ladon *var.* cinerea *Edw.* Arizona
C. ladon *var.* neglecta *Edw.* New York
C. ladon *var.* piasus *Boisd.* California
Everes (Lycaena) amyntula *Boisd.* California
E. (Lycaena) comyntas *Godt.* New York
Hemiargus isola *Reak.* (Lycaena alce *Edw.*). Texas
H. (Lycaena) gyas *Edw.* Texas
H. hanno *Stoll.* (Lycaena filenus *Poey*). Georgia
H. (Lycaena) ammon *Lucas.* Florida
Brephidium (Lycaena) isophthalma *Herr.-Schaef.* Florida
B. (Lycaena) exilis *Boisd.* Texas
Leptotes (Lycaena) marina *Reak.* South California
Lampides (Lycaena) boeticus *Linn.* Europe

Megathymidae

Megathymus yuccae *Boisd. & Lec.* Florida
M. cofaqui *Streck.* Texas

Hesperiidae

Pyrrhopyga phidias *Linn.* Bogota
P. *sp.* Peru
P. acastus *Cram.* Georgia
P. genetus *Fabr.* Brazil
Entheus peleus *Linn.* Brazil
E. busiris *Fabr.* Brazil
E. vitreus *Cram.* South America
Amblyscirtes vialis *Edw.* New York
Carcharodus (Erynnis) alceae *Esp.* Europe
C. (Erynnis) lavatherae *Esp.* Hungary
Heteropterus morpheus *Pall.* Europe
Pamphila palaemon *Pall.* (Carterocephalus mandan *Edw.*). Maine, New York, Europe
P. (Carterocephalus) silvius *Knoch.* Europe
Ancyloxypha numitor *Fabr.* New York, Ohio
Copaeodes (Heteropterus) procris *Edw.* Texas
Oarisma (Pamphila) garita *Reak.* Colorado
Poanes (Pamphila) massasoit *Scudd.* New York
Atrytone (Pamphila) zabulon *Boisd. & Lec.* Ohio
A. hobomok *Harr.* Massachusetts, New York
A. (Pamphila zabulon) hobomok *var.* pocahontas *Scudd.* Ohio
Augiades (Pamphila) sylvanus *Esp.* Europe
Erynnis (Pamphila) comma *Linn.* New Mexico, Colorado, Europe
E. (Pamphila) comma *var.* colorado *Scudd.* Colorado
E. (Pamphila) sassacus *Harr.* Maine
E. (Pamphila) pawnee *Dodge.* Nebraska
E. (Pamphila) ottoe *Edw.* Kansas
E. (Pamphila) napa *Edw.* Colorado
E. (Pamphila) metea *Scudd.* New York
E. (Pamphila) carus *Edw.* Jamaica
E. (Pamphila) uncas *Edw.* Florida
Anthomaster (Pamphila) snowi *Edw.* New Mexico
A. (Pamphila) leonardus *Harr.* New York
A. (Pamphila) nemorum *Boisd.* Washington
A. (Pamphila) sylvanoides *Boisd.* California
A. (Pamphila) agricola *Boisd.* Colorado
Hylephila (Pamphila huron *Edw.*) campestris *Boisd.* Wisconsin
H. (Pamphila) phylaeus *Dru.* Texas
Thymelicus (Pamphila) brettus *Boisd. & Lec.* Florida
T. (Pamphila) draco *Edw.* Colorado
T. (Pamphila) otho *Sm. & Abb.* Florida
T. (Pamphila) otho *var.* egeremet *Scudd.* Massachusetts
T. (Pamphila) mystic *Scudd.* New York
T. (Pamphila) siris *Edw.* Washington
T. (Pamphila) cernes *Boisd. & Lec.* New York
Adopaea (Thymelicus) thaumas *Hufn.* Europe
A. (Thymelicus) lineola *Och.* Europe
A. (Thymelicus) acteon *Rott.* Germany
Polites (Pamphila) sabuleti *Boisd.* California
P. (Pamphila) peckius *Kirby.* New York
Euphyes (Pamphila) verna *Edw.* Ohio
E. vestris *Boisd. var.* metacomet *Harr.* New York
E. (Pamphila) eufala *Edw.* Florida
Lerema (Pamphila) accius *Sm. & Abb.* Florida
L. (Pamphila) hianna *Scudd.* New York
Oligoria (Pamphila) maculata *Edw.* Florida

Prenes (Pamphila) panoquin *Scudd.* Florida
P. (Pamphila) ocola *Edw.* Florida
Calpodes (Pamphila) ethlius *Cram.* Jamaica, Florida
Limochroes (Pamphila) bimacula *Grt. & Rob.* New York
L. (Pamphila) pontiac *Edw.* Ohio
L. (Pamphila) manataaqua *Scudd.* New York
L. (Pamphila) arpa *Boisd. & Lec.* Florida
L. (Pamphila) byssus *Edw.* Texas
Phycanassa (Pamphila) viator *Edw.* Florida
P. vitellius *Fabr.* (Pamphila delaware *Edw.*). Florida
P. arogos *Boisd.* (Pamphila iowa *Scudd.*). Nebraska
Erycides amyntas *Fabr.* Texas
Eudamus proteus *Linn.* Florida
E. *sp.* Mexico
Epargyreus (Thymele) tityrus *Fabr.* New York
Thymele antaeus *Hew.* Brazil
T. exadeus *Cram.* South America
Rhabdoides (Eudamus) cellus *Boisd. & Lec.* Arizona
Telegonus fulgerator *Walch.* Brazil
T. habana *Luc.* Cuba
T. talus *Cram.* Santo Domingo
Achlarus (Eudamus) lycidas *Sm. & Abb.* New York
Thorybes (Eudamus) hippalus *Edw.* Arizona
T. caicus *Herr.-Schaef.* (Eudamus moschus *Edw.*). Arizona
T. (Eudamus) bathyllus *Sm. & Abb.* North Carolina, Kansas
T. (Aethilla) pylades *Scudd.* New York
Achylodes lassia *Hew.* Brazil
A. busirus *Cram.* Brazil
Pholisora catullus *Fabr.* New York, Tennessee
P. ceos *Edw.* Arizona
P. hayhurstii *Edw.* Wisconsin
P. (Nisoniades) alpheus *Edw.* Arizona
Systasea pulverulenta *Feld.* (zampa *Edw.*). Texas
Antigonus erosus *Hübn.* Brazil
Pythonides tryxus *Cram.* South America
Thanaos (Nisoniades) tages *Linn.* Europe
T. (Nisoniades) brizo *Boisd. & Lec.* New York
T. (Nisoniades) icelus *Lintn.* New York
T. (Nisoniades) lucilius *Lintn.* New York
T. (Nisoniades) persius *Scudd.* New York
T. (Nisoniades) martialis *Scudd.* New York
T. (Nisoniades) juvenalis *Fabr.* New York, Kansas, Florida
T. (Nisoniades) propertius *Lintn.* Vancouver
T. (Nisoniades) naevius *Lintn.* Florida
T. (Nisoniades) funeralis *Scudd. & Berg.* Texas
Hesperia (Pyrgus) tessellata *Scudd.* Kansas
H. (Pyrgus) caespitalis *Boisd.* Colorado
H. carthami *Hübn.* Europe
H. (Syrichthus) serratulae *Ramb.* Europe
H. alveus *Hübn.* Europe
H. (Syrichthus) cacaliae *Ramb.* Europe
H. centaureae *Ramb.* Scandinavia
H. cynarae *Ramb.* Russia
H. malvae *Linn.* Europe
H. sao *Hübn.* Europe
H. (Syrichthus) orbifer *Hübn.* Europe
Leucochitonea arsalte *Linn.* South America
Trapezites iacchus *Fabr.* Australia

Sphingidae

Hemaris diffinis *Boisd.* New York, Canada
H. diffinis *var.* axillaris *Grt. & Rob.* (marginalis *Grt.*)
H. diffinis *var.* tenuis *Grt.* New York
H. diffinis *var.* thetis *Grt. & Rob.* California
H. gracilis *Grt. & Rob.* New York
H. thysbe *Fabr.* New York
H. thysbe *var.* ruficaudis *Kirby.* (*var.* uniformis. *Grt. & Rob.*). New York
H. fuciformis *Linn.* (bombyliformis *Och.*). Europe
Macroglossa (Hemaris) stellatarum *Linn.* Europe
M. (Hemaris) croatica *Esp.* Europe
M. hylas ? Java
Lepisesia (Pogocolon) clarkiae *Boisd.* South California
Aellopos tantalus *Linn.* (titan *Cram.*). Mexico
Metopsilus (Deilephila) porcellus *Linn.* Europe
M. (Pergesa) acteus *Cram.* Brazil
Pterogon proserpina *Pall.* Europe
Triptogon lugubris *Linn.* (Enyo-camertus *Cram.*). Florida, Jamaica
Pachygonia subhamata *Walk.* (calignosa *Feld.*). Brazil
Amphion nessus *Cram.* New York, Nebraska
Sphecodina (Thyreus) abbotii *Swain.* New York
Chaerocampa (Deilephila) celerio *Linn.* Asia, Europe
C. (Deilephila) alecto *Linn.* Europe
C. (Deilephila) elpenor *Linn.* Europe
Deilephila gallii *Rott.* (chamoeneru *Kan.*). New York, Canada, Europe
D. lineata *Fabr.* New York
D. lineata *var.* livornica *Esp.* Dalmatia
D. vespertilio *Esp.* Europe
D. hippophaes *Esp.* Europe
D. euphorbiae *Linn.* Europe
D. dahlii *Hübn.* Europe
Daphnis (Deilephila) nerii *Linn.* Europe
Theretra (Chaerocampa) tersa *Linn.* Jamaica, Florida
T. (Chaerocampa) chiron *Dru.* Brazil
Argeus labruscae *Linn.* Florida, Paraguay
Pachylia ficus *Linn.* Cuba
P. inornata *Clem.* Brazil
Ambulyx strigilis *Linn.* Brazil
Pholus linnei *Grt. & Rob.* Brazil
P. (Philampelus) vitis *Linn.* Georgia
P. pandorus *Hübn.* New York
P. achemon *Dru.* New York
Philampelus (Pholus) anchemolus *Cram.* Brazil
Ampelophaga (Everyx) choerilus *Cram.* New York
A. myron *Cram.* United States
A. versicolor *Harr.* Long Island
Cocytius (Macrosila) antaeus *Dru.* Brazil
C. (Sphinx) cluentius *Cram.* Jamaica
Pseudosphinx tetrio *Linn.* Cuba
Dilophonota ello *Linn.* Brazil, Florida
D. alope *Dru.* (edwardsii *Butl.*). Florida
D. obscura *Fabr.* Florida
Cautethia noctuiformis *Walk.* *var.* grotei *Hy. Edw.* Florida
Phlegethontius quinquemaculata *Haw.* (celeus *Hübn.*). New York, Ohio
P. sexta *Johan.* (carolina *Linn.*). New York
P. rustica *Fabr.* Georgia
P. (Sphinx) convolvuli *Linn.* Europe, Asia
P. convolvuli *var.* cingulata *Fabr.* Georgia, Kansas
P. (Protoparce) jamaicensis *Butl.* Jamaica
P. roseofasciata *Koch.* (Sphinx distans *Butl.*). Jamaica
P. (Sphinx) paphus *Stoll.* Paraguay
Hyloicus (Sphinx) pinastri *Linn.* Europe

Sphinx kalmiae *Sm. & Abb.* New York, Maine
S. drupiferarum *Sm. & Abb.* Canada, Maine, New York
S. perelegans *Hy. Edw.* California
S. gordius *Stoll.* New York
S. lucitiosa *Clem.* Maine
S. chersis *Hübn.* Maine
S. (Hyloicus) sequoiae *Boisd.* California
S. canadensis *Boisd.* New York
S. andromeda *Boisd.* (separatus *Newm.*). New Mexico
S. lugens *Walk.* Kansas
S. eremitus *Hübn.* New York
S. (Hyloicus) plebeia *Fabr.* Georgia, Texas
S. ligustri *Linn.* Europe
Dolba hylaeus *Dru.* New York
Ceratomia amyntor *Hübn.* Ohio, New York
C. (Daremma) undulosa *Walk.* New York, Ohio
C. (Daremma) hageni *Grt.* Kansas
C. (Daremma) catalpae *Boisd.* Florida
Lapara (Ellema) bombycoides *Walk.* New York
L. (Ellema) pineum *Lintn.* New York
L. (Ellema) coniferarum *Sm. & Abb.* Southern States
Marumba (Triptogon) modesta *Harr.* New York
Dilina (Smerinthus) tiliae *Linn.* Russia
Smerinthus jamaicensis *Dru.* (geminatus *Say*). New York
S. cerysii *Kirby.* New York
S. cerysii *var.* ophthalmicus *Boisd.* California
S. quercus *Schiff.* Europe
S. ocellata *Linn.* Europe
S. populi *Linn.* Europe
Paonias excaecatus *Sm. & Abb.* Maine
P. (Calasymbolus) myops *Sm. & Abb.* New Jersey
P. (Calasymbolus) astylus *Dru.* New Jersey
Cressonia juglandis *Sm. & Abb.* New York
Acherontia atropos *Linn.* Europe

Saturniidae

Antheraea pernyi *Guer.* Japan, (New York, from eggs)
A. pernyi *var.* yamamai *Guer.* Japan
A. mylitta *Dru.* India
Attacus atlas *Linn.* Java
A. betis *Walk.* Brazil
A. hesperus *Linn.* (aurota *Cram.*). Rio de Janeiro
Philosamia cynthia *Dru.* Long Island
Samia (Platysamia) cecropia *Linn.* Albany, N. Y.
S. (Platysamia) gloveri *Streck.* Dayton, O.
S. (Platysamia) columbia *Smith.* Orono, Me.
S. rubra *Behr.* (Platysamia ceanothi *Behr.*). California
Callosamia promethea *Dru.* Albany, N. Y.
C. angulifera *Walk.* Long Island
Tropea (Actias) luna *Linn.* Atlantic States, Mississippi valley
Telea polyphemus *Cram.* Newark, N. J.
Saturnia pyri *Schiff.* Europe
S. spini *Schiff.* Europe
S. pavonia *Linn.* Russia
S. rubrescens ? Chili
Automeris (Hyperchiria) io *Fabr.* Orono, Me.
Hemileuca maia *Dru.* Wisconsin
H. nevadensis *Stretch.* (maia *var.* nevadensis *Stretch*). Nevada
Aglia tau *Linn.* Saxony
Pseudohazis eglanterina *Boisd.* California
P. hera *Harr.* Utah

Ceratocampidae

Anisota stigma *Fabr.* Centre, N. Y.
A. senatoria *Sm. & Abb.* Centre, N. Y.
A. (Dryocampa) rubicunda *Fabr.* Albany, N. Y.
A. (Dryocampa) rubicunda *var.* alba *Grt.* Douglas county, Kan.
Adelocephala (Sphingicampa) bicolor *Harr.* Dayton, O.
Citheronia regalis *Fabr.* New York
C. (Basilona) cacicus *Walk.* Brazil
Hyperchiria virescens *Neum.* Buenos Ayres
H. corescens *Neum.* Buenos Ayres
Basilona (Eacles) imperialis *Dru.* New York

Syntomidae

Syntomis phegea *Linn.* Europe
Dysauxes (Naclia) ancilla *Linn.* Europe
Cosmosoma (omphale *Hübn.*) auge *Linn.* Florida
Didasys belae *Grt.* Florida
Lymire (Scepsis) edwardsi *Grt.* Florida
Scepsis fulvicollis *Hübn.* New York
S. wrightii *Stretch.* California
Lycomorpha (Anatolsnis) grotei *Pack.* Colorado
L. pholus *Dru.* New York
Ctenucha venosa *Walk.* Texas
C. cressonana *Grt.* Colorado
C. brunnea *Stretch.* California
C. multifaria *Walk.* California
C. rubroscapus *Menc.* (walsinghami *Hy. Edw.*). California
C. rubroscapus *Menc. var.* ochroscapus *Grt. & Rob.* California
C. virginica *Charp.* New York, Ontario
Dahana atripennis *Grt.* Florida

Heterogynidae

Heterogynis penella *Hübn.* Europe

Zygaenidae

Agyrta auxo *Linn.* Brazil
Zygaena erythrus *Hübn.* Europe
Z. purpuralis *Brun.* (pilosellae *Esp.*). Europe
Z. purpuralis *var.* nubigena *Led.* Europe
Z. brizae *Esp.* Europe
Z. scabiosae *Esp.* Europe
Z. punctum *Och.* Europe
Z. cambysea *Led.* Europe
Z. armena *Ev.* Europe
Z. achilleae *Esp.* Europe
Z. cynarae *Esp.* Europe
Z. exulans *Hoch. & Rein.* Europe
Z. meliloti *Esp.* Europe
Z. trifolii *Esp.* Europe
Z. lonicerae *Esp.* Europe
Z. filipendulae *Linn.* Europe
Z. angelicae *Och.* Europe
Z. transalpina *Esp.* Europe
Z. filipendulae *Linn. var.* tutti *Rbl.* (hippocrepides *Hübn.*). Europe
Z. ephialtes *Linn.* Europe
Z. ephialtes *var.* coronillae *Esp.* Europe
Z. ephialtes *var.* pencedani *Esp.* Europe
Z. lavandulae *Esp.* Europe
Z. rhadamanthus *Esp.* Europe
Z. manlia *Led.* Europe
Z. laeta *Hübn.* Europe
Z. algira *Dup.* Europe
Z. fausta *Linn.* Europe
Z. fausta *var.* jucunda *Meis.* Europe
Z. carniolica *Scop.* Europe
Z. occitanica *Vill.* Europe
Z. occitanica *var.* albicans *Stegr.* Europe

Aglaope infausta *Linn.* Europe
Ino ampelophaga *Bayle.* Europe
I. pruni *Schiff.* Europe
I. chloros *Hübn.* Europe
I. tenuicornis *Zett.* Europe
I. globulariae *Hübn.* Europe
I. budensis *Spr.* Europe
I. statices *Linn.* Europe
I. geryon *Hübn.* Europe
Euchromia sperchius *Cram.* West Africa
Glaucopis pulchella *Cram.* Brazil
G. senegalensis *Walk.* Senegal
G. formosa *Boisd.* Madagascar

Lithosiidae

Crambidia pallida *Pack.* South Abington, Mass.
C. casta *Sanborn* (Lithosia candida *Sanborn*). Saranac Lake, N. Y.
Hypoprepia miniata *Kirby* (fuscosa *var.* miniata *Krb.*). Hamilton, Ont.
Clemensia albata *Pack.* Hamilton, Ont.
Illice (Cisthene) subjecta *Walk.* Texas
I. (Byssophaga) nexa *Boisd.* Marino county, Cal.

Arctiidae

Eubaphe laeta *Guerin* (Crocota treatii *Grt.*). Rockledge, Fla.
E. (Crocota) opella *Grt.* Rockledge, Fla.
E. (Crocota) aurantiaca *Hübn. var.* rubicundaria *Hübn.* Rockledge, Fla.
E. (Crocota) aurantiaca *var.* ferruginosa *Walk.* Saranac Lake, N. Y.
Pelosia muscerda *Hufn.* Pomerania
Lithosia caniola *Hübn.* Europe
L. unita *Hübn.* Europe
L. unita *var.* arideola *Hering.* Pomerania
L. sororcula *Hufn.* Europe
L. lurideola *Zinck.* Europe
L. complana *Linn.* Europe
Oeonistis (Gnophria) quadra *Linn.* Europe
Gnophria rubricollis *Linn.* Europe
Comacla (Nudaria) senex *Hübn.* Europe
Cybosia (Setina) mesomella *Linn.* Europe
Endrosa (Setina) irrorella *Clem.* Europe
E. (Setina) irrorella *var.* flavicans *Boisd.* Europe
E. (Setina) roscida *Esp.* Europe
Paidia (Nudaria) murina *Hübn.* Europe
Miltochrista rosacea *Brem.* (Caligenia rosea *Fabr.*). Europe
M. miniata *Forst.* (rosea *Esp.*). China
Nudaria mundana *Linn.* Europe
Deiopeia pulchella *Linn.* Europe
Hipocrita (Euchelia) jacobaeae *Linn.* Europe
Coscinia (Emydia) cribrum *Linn.* Europe
C. (Emydia) cribrum *var.* punctigera *Frr.* Germany
Utetheisa bella *Linn.* Albany, N. Y.
U. ornatrix *Linn.* South America
Haploa (Callimorpha) clymene *Brown.* Texas
H. (Callimorpha interruptomarginata *Pal. Beauv.*) clymene *Brown.* Atlantic States, Kansas
H. (Callimorpha) colona *Hübn. var.* reversa *Stretch.* Douglas county, Kan.
H. colona *var.* fulvicosta *Clem.* (Callimorpha lecontei *Boisd. var.* fulvicosta *Clem.*). Illinois
H. (Callimorpha) lecontei *Boisd.* Illinois
H. (Callimorpha) lecontei *var.* confinis *Walk.* Lewis county, N. Y.

Haploa (Callimorpha) lecontei *var.* vestalia *Pack.* Douglas county, Kan.
Callimorpha quadripunctaria *Poda.* (hera *Linn.*). Europe
C. dominula *Linn.* Europe
Axiopoena maura *Eichwald.* Russia
Pericallia (Pleretes) matronula *Linn.* Europe
Euerythra phasma *Harvey.* Texas
Ecpantheria deflorata *Fabr.* (scribonia *Stoll.*). Florida
Estigmene (Leucarctia) acraea *Dru.* Glenville, N. Y.
E. (Spilosoma) congrua *Walk.* Brockport, N. Y.
Hyphantria cunea *Dru.* Albany, N. Y.
H. textor *Harr.* Albany, N. Y.
Isia (Pyrrharctia) isabella *Sm. & Abb.* Albany, N. Y.
Spilosoma mendica *Clem.* Holland
S. lubricipeda *Linn.* Europe
S. menthastri *Esp.* Europe
S. urticae *Esp.* Europe
Phragmatobia (Spilosoma) fuliginosa *Linn.* Europe
P. fuliginosa *Linn.* (rubricosa *Harr.*). Elliot, N. Y.
Diacrisia (Spilosoma) virginica *Fabr.* Centre, N. Y.
D. (Spilosoma) latipennis *Stretch.* Albany, N. Y.
D. (Antarctia) vagans *Boisd.*
D. sanio *Linn.* (Nemeophila russula *Linn.*). Europe
Arctinia caesarea *Goeze* (Spilosoma luctifera *Esp.*). Europe
Ocnogyna corsicum *Rbr.* (corsica). Europe
Rhyparia (Arctia) purpurata *Linn.* Europe
Hyphoraia (Platarctia) parthenos *Harr.* Adirondack mts, N. Y.
Platyprepia (Epicallia) virginalis *Boisd.* California
Apantesis (Arctia) virgo *Linn.* Hamilton, Ont.
A. (Arctia) virguncula *Kirby.* Hamilton, Ont.
A. (Arctia) michabo *Grt.* Nebraska
A. parthenice *Kirby* (Arctia) saundersii *Grt.* Adirondack mts, N. Y.
A. oithona *Streck.* (Arctia rectilinea *Fr.*). Kansas
A. (Arctia) ornata *Pack. var.* archaia *Grt. & Rob.* California
A. (Arctia) ornata *var.* ochracea *Stretch.* California
A. (Arctia) arge *Dru.* Albany, N. Y.
A. proxiana *Guer.* (Arctia mexicana *Grt. & Rob.*). California to Utah
A. (Arctia) nevadensis *Grt. & Rob.* var. incorrupta *Hy. Edw.* Arizona
A. (Arctia) phyllira *Dru.* Mt Kisco, N. Y.
A. (Arctia) nais *Dru.* Rockledge, Fla.
Parasemia (Nemeophila) plantaginis *Linn.* Europe, Calabar
Arctia (Euprepia) caia *Linn.* Sharon, N. Y.
Arctia *sp.* Arizona
A. flavia *Fuessl.* Europe
A. villica *Linn.* Europe
A. aulica *Linn.* Europe
A. testudinaria *Fourc.* (maculania *Lang.*). Europe
A. hebe *Linn.* Dalmatia
A. casta *Esp.* Europe
A. spectabilis *Tausch.* Europe
Euprepia pudica *Esp.* Europe
Ammalo tenera *Hübn.* (Euchaetes collaris *Fitch*). Hamilton, Ont.
Euchaetias (Euchaetes) egle *Dru.* Tiffin, O.
E. (Euchaetes) oregonensis *Stretch.* Centre, N. Y.
Eucareon sylvius *Stoll.* Brazil
Halisidota tessellaris *Sm. & Abb.* (tessellata *Sm. & Abb.*). Lewis county, N. Y.
H. maculata *Harr.* Albany, N. Y.
H. caryae *Harr.* Albany, N. Y.
Euschausia argentata *Pack.* (Halisidota sobrina *Stretch*). California
Hyalurga fenestra *Linn.* Brazil

Agaristidae

Alypia ridingsii *Grt.* Nevada
A. octomaculata *Fabr.* New York
Copidryas gloveri *Grt. & Rob.* Texas
Agarista glycino *Fabr.* Australia
A. picta *Cram.* Queensland
Ethema dichroa *Hübn.* Bogota
Castnia phaleris *Guen.* Brazil

Uranidae

Urania fulgens *Linn.* Bogota
U. leilus *Linn.* Bogota
U. sloanus *Cram.* Jamaica
U. rhipheus *Cram.* Madagascar

Noctuidae

Panthea (Audela) acronyctoides *Walk.* Mt Kisco, N. Y.
Demas (Charadra) propinquilinea *Grt.* Albany, N. Y.
Charadra deridens *Guen.* Lewis county, N. Y.
Raphia frater *Grt.* Centre, N. Y.
R. coloradensis *Cram.* (abrupta *Grt. var.*). Colorado
Demas coryli *Linn.* Europe
Apatela rubricoma *Guen.* Centre, N. Y.
A. (Acronycta) americana *Harr.* Centre, N. Y.
A. (Acronycta) hastulifera *Sm. & Abb.* Centre, N. Y.
A. (Acronycta) dactylina *Grt.* Lewis county, N. Y.
A. (Acronycta) felina *Grt.* Saranac Lake, N. Y.
A. (Acronycta) leporina *Linn.* Europe
A. (Acronycta) lepusculina *Guen.* Colorado
A. innotata *Guen.* Centre, N. Y.
A. (Acronycta) betulae *Riley.* Washington, D. C.
A. morula *Grt.* Lewis county, N. Y.
A. interrupta *Guen.* (occidentalis *Grt. & Rob.*). Lewis county, N. Y.
A. lobeliae *Guen.* Centre, N. Y.
A. (Acronycta) furcifera *Guen.* Wisconsin
A. (Acronycta) hasta *Guen.* Lewis county, N. Y.
A. radcliffei *Harv.* Centre, N. Y.
A. spinigera *Guen.* (Acronycta harveyana *Grt.*). Wisconsin
A. (Acronycta) clarescens *Guen.* Centre, N. Y.
A. (Acronycta) hamamelis *Guen.* Lewis county, N. Y.
A. (Acronycta) superans *Guen.* Lewis county, N. Y.
A. (Acronycta) lithospila *Grt.* Centre, N. Y.
A. tritona *Hübn.* Centre, N. Y.
A. (Acronycta) connecta *Grt.* New York
A. (Acronycta) funeralis *Grt.* Centre, N. Y.
A. (Micrococelia) fragilis *Guen.* Lewis county, N. Y.
A. (Acronycta) paupercula *Grt.* Texas
A. (Acronycta) vinnula *Grt.* Albany, N. Y.
A. grisea *Walk.* Lewis county, N. Y.
A. (Acronycta) afflicta *Grt.*
A. (Acronycta) albarufa *Grt.* Centre, N. Y.
A. modica *Walk.* (Acronycta exilis *Grt.*). Kansas
A. (Acronycta) ovata *Grt.* New York
A. brumosa *Guen.* Lewis county, N. Y.
A. retardata *Walk.* (Acronycta dissecta *Grt. & Rob.*). Hamilton, Ont.
A. (Acronycta) sperata *Grt.* Centre, N. Y.
A. (Acronycta) noctivaga *Grt.* Lewis county, N. Y.
A. (Acronycta) xyliniformis *Guen.* Kansas; Centre, N. Y.

Acronycta impleta *Walk.* (luteicoma *Grt. & Rob.*). Centre, N. Y.
A. (Acronycta) oblinita *Sm. & Abb.* Albany, N. Y.
Apharetra dentata *Grt.* Lewis county, N. Y.
Acronycta aceris *Linn.* Europe
A. megacephala *Fabr.* Europe
A. tridens *Schiff.* Europe
A. rumicis *Linn.* Europe
A. psi *Linn.* Europe
A. menyanthidis *View.* Europe
A. auricoma *Fabr.* Europe
A. euphorbiae *Fabr.* Europe
A. abscondita *Treit.* Europe
Craniophora (Acronycta) ligustri *Fabr.* Europe
Oxycesta (Clidia) geographica *Fabr.* Europe
Eogena contaminei *Ever.* Russia
Simyra dentinosa *Frr.* Siberia
Arsilonche albovenosa *Goeze.* Albany, N. Y.; Cambridge, Mass.
Harrisimemna trisignata *Walk.* Connecticut
Microcoelia dipteroides *Guen.* Schenectady, N. Y.
M. dipteroides *var.* obliterata *Grt.* Lewis county, N. Y.
Jaspidea celsia *Linn.* Berlin
J. (Bryophila) lepidula *Grt.* Centre, N. Y.
Bryophila algae *Fabr.* Europe
B. muralis *Forst.* Hungary
B. perla *Fabr.* Europe
B. fraudatricula *Hübn.* Europe
B. raptricula *Hübn.* Europe
Diphthera fallax *Herr.-Schaef.* Centre, N. Y.
D. alpium *Osbeck* (Moma orion *Esper.*). Europe
Trichosea (Diphtera) ludifica *Linn.* Europe
Cyathisa percara *Morr.*
Chytonix palliatricula *Guen.* Sharon, N. Y.
Baileya (Leptina) ophthalmica *Guen.* Kansas
B. (Leptina) doubledayi *Guen.* Centre, N. Y.
B. (Leptina) dormitans *Guen.* Kittery Point, Me.
Hadenella (Parastichtis) minuscula *Morr.* Lewis county, N. Y.
Acopa perpallida *Grt.* Kansas
Catabena lineolata *Walk.* (Adisophanes miscellus *Grt.*). Albany, N. Y.
Crambodes talidiformis *Guen.* Atlantic States, Kansas
Platysenta videns *Guen.* (atriciliata *Grt.*). Texas
Balsa (Nolophana) malana *Fitch.* Hamilton, Ont.
B. tristrigella *Walk.* (Nolophana zelleri *Grt.*). Centre, N. Y.
Caradrina meralis *Morr.* Atlantic States, Colorado
C. multifera *Walk.* Lewis county, N. Y.
C. *sp.* Colorado
C. miranda *Grt.* Albany, N. Y.
C. derosa *Morr.* Centre, N. Y.
C. exigua *Hübn.* Russia
C. quadripunctata *Fabr.* (cubicularis *Bkh.*). Europe
C. selina *Boisd.* France
C. kadenii *Frr.* Europe
C. respersa *Hübn.* Europe
C. alsines *Brahm.* Europe
C. ambigua *Fabr.* Europe
C. pulmonaris *Esp.* Europe
C. lenta *Treit.* Europe
Perigea xanthioides *Guen.* Tiffin, O.
P. vecors *Guen.* (luxa *Grt.*). Tiffin, O.
P. epopea *Cram.* (infelix *Guen.*). Savannah, Ga.
P. sutor *Guen.* (fabrefacta *Morr.*). Newton, Mass.
P. albolabes *Grt.* Arizona, Las Vegas, N. M.
Oligia chalcedonia *Hübn.* (arna *Guen.*). Centre, N. Y.; Lewis county, N. Y.
O. versicolor *Grt.* Lewis county, N. Y.
O. fuscimacula *Grt.* Rockledge, Fla.
O. (Caradrina) grata *Hübn.* Douglas county, Kan.

Hillia crassis *Herr.-Schaef.* (senescens *Grt.*). Lewis county, N. Y.
H. algens *Grt.* Lewis county, N. Y.
Hadena claudens *Walk.* (hillii *Grt.*). Lewis county, N. Y.
H. binotata *Walk.* Washington
H. indirecta *Grt.* Washington
H. modica *Guen.* Centre, N. Y.
H. genetrix *Grt.* Colorado
H. mactata *Guen.* Albany, N. Y.
H. turbulenta *Hübn.* Savannah, Ga.
H. *sp.* California
H. miseloides *Guen.* Texas
H. semicana *Walk.* *var.* fractilinea *Grt.* Centre, N. Y.
H. semicana *Walk.* (vulgivaga *Morr.*). Centre, N. Y.
H. basilinea *Fabr.* Europe
H. (Luceria) passer *Guen.* Lewis county, N. Y.
H. (Luceria) burgessi *Morr.* Nebraska
H. longula *Grt.* Colorado
H. remissa *Hübn.* Lewis county, N. Y.
H. suffusca *Morr.* Wisconsin
H. vultuosa *Grt.* Wisconsin
H. apamiformis *Guen.* Albany, N. Y.
H. finitima *Guen.* Albany, N. Y.
H. dubitans *Walk.* (sputatrix *Grt.*) (lateritia *Grt.* & *Rob.*). Lewis county, N. Y.
H. ducta *Grt.* Saranac Lake, N. Y.
H. impulsa *Guen.* Lewis county, N. Y.
H. devastatrix *Brace.* Lewis county, N. Y.
H. exulis *Lefb.* Labrador
H. pluviosa *Walk.* (castania *Grt.*). Washington
H. perpensa *Grt.* Hot Springs
H. verbascoides *Guen.* Lewis county, N. Y.
H. cariosa *Guen.* Douglas county, Kan.
H. vulgaris *Grt.* & *Rob.* Albany, N. Y.
H. auranticolor *Grt.* Colorado
H. lignicolor *Guen.* Lewis county, N. Y.
H. inordinata *Morr.* Maine
H. semilunata *Grt.* Colorado
H. arctica *Boisd.* Centre, N. Y.
H. porphyrea *Esp.* Europe
H. solieri *Boisd.* Russia
H. adusta *Esp.* Europe
H. ochroleuca *Esp.* Europe
H. furva *Hübn.* Russia
H. sordida *Bkh.* Europe
H. leucodon *Ever.* Siberia
H. monoglypha *Hufn.* Europe
H. (Luperina) ferrago *Ever.* Ural mts
H. lithoxylea *Fabr.* Europe
H. rurea *Fabr.* Europe
H. unanimis *Treit.* Europe
H. secalis *Linn.* (didyma *Esp.*). Europe
Miana (Hadena) strigilis *Clerck.* Europe
M. (Hadena) strigilis *var.* latruncula *Hübn.* Europe
Oxytripia orbiculosa *Esp.* Hungary
Celaena (Luperina) haworthii *Curt.* Europe
C. (Luperina) matura *Hufn.* Europe
Luceria (Luperina) virens *Linn.* Europe
Calophasia casta *Bkh.* Europe
C. lunula *Hufn.* Europe
Cleophana antirrhinii *Hübn.* Europe
Scotochrosta pulla *Hübn.* Europe
Xylocampa areola *Esp.* Europe
Lithocampa ramosa *Esp.* Europe
Macronoctua onusta *Grt.* Orono, Me.
Polia theodori *Grt.* Colorado
P. contacta *Walk.* Lewis county, N. Y.
P. acutissima *Grt.* Oldtown, Me.
P. serpentina *Treit.* Europe
P. polymita *Linn.* Europe
P. rufocincta *Hübn.* Europe
P. xanthomista *Hübn.* Europe
P. xanthomista *var.* nigrocincta *Treit.* Europe
P. chi *Linn.* Europe
Brachionycha (Asteroscopus) nubeculosa *Esp.* Europe
B. (Asteroscopus) sphinx *Hufn.* Europe

Miselia oxyacanthae *Linn.* Europe
Chariptera viridana *Walch.* Europe
Dichonia aprilina *Linn.* Europe
D. aeruginea *Hübn.* Europe
D. convergens *Fabr.* Europe
Dryobota illocata *Walk.* (stigmata *Grt.*). Centre, N. Y.
D. furva *Esp.* Europe
D. roboris *Boisd.* Europe
D. saportae *Dup.* Europe
D. monochroma *Esp. var.* suberis *Boisd.* Europe
D. protea *Bkh.* Europe
Rhizogramma detersa *Esp.* Europe
Hyppa xylinoides *Guen.* Centre, N. Y.; Adirondack mts, N. Y.
H. rectilinea *Esp.* Europe
Feralia jocosa *Guen.*
Momorphana comstocki *Grt.* Centre, N. Y.
Diloba caeruleocephala *Linn.* Europe
Valeria jaspidea *Vill.* Europe
V. oleagina *Fabr.* Europe
Euplexia lucipara *Linn.* Centre, N. Y.; Lewis county, N. Y.
Dipterygia scabriuscula *Linn.* Centre, N. Y.; Schenectady, N. Y.
D. scabriuscula *var.* spadica ? Europe
Rusina umbratica *Goeze* (tenebrosa *Hübn.*). Europe
Pyrophila glabella *Morr.* New Mexico
P. (Amphipyra) pyramidoides *Guen.* Lewis county, N. Y.
P. (Amphipyra) tragopoginis *Linn.* Europe; Lewis county, N. Y.
Amphipyra tetra *Fabr.* Europe
A. livida *Fabr.* Europe
A. pyramidea *Linn.* Europe
Helotropha leucostigma *Hübn.* Europe
H. leucostigma *var.* fibrosa *Hübn.* Europe
H. reniformis *Grt.* Lewis county, N. Y.
Prodenia commelinae *Sm. & Abb.* Jamaica, America
P. ornithogalli *Guen.* (lineatella *Harv.*). Tiffin, O.
P. ornithogalli *Guen. var.* eudiopta *Guen.* (flavimedia *Harv.*). Kansas
Laphygma frugiperda *Sm. & Abb.* Wisconsin
L. frugiperda *var.* obscura *Riley.* Centre, N. Y.
Magusa dissidens *Feld.* (Stichtoptera divaricata *Grt.*). Texas
Pseudanarta flava *Grt.* Colorado
P. flavidens *Grt.* Colorado
Homohadena badistriga *Grt.* Hamilton, Ont.
H. infixa *Walk.* (kappa *Grt.*). Lewis county, N. Y.
H. induta *Harv.* Texas
Oncocnemis chandleri *Grt.* Colorado
O. riparia *Morr.* Long Island
O. (Homohadena) atrifasciata *Morr.* Lewis county, N. Y.
O. glennyi *Grt.* Colorado
O. confusa *Frr.* Russia
Episema scoriacea *Esp.* Europe
Ulochlaena hirta *Hübn.* Russia
Aporophyla australis *Boisd.* Dalmatia
A. nigra *Hew.*
Adita chionanthi *Sm. & Abb.* Lewis county, N. Y.
Copipanolis cubilis *Grt.* Texas
Eutolype rolandi *Grt.* Texas
Psaphidia resumens *Walk.* (Dicopis muralis *Grt.*). Newtonville, N. Y.
Rhynchagrotis gilvipennis *Grt.* (Agrotis chardinyi *Boisd.*). Lewis county, N. Y.
R. (Agrotis) rufipectus *Morr.* Saranac Lake, N. Y.
R. (Agrotis) brunneicollis *Grt.* South Abington, Mass.
R. (Agrotis) minimalis *Grt.* Colorado
R. anchocelioides *Guen.* (Agrotis cupida *Grt.*). Centre, N. Y.
R. anchocelioides *var.* brunneipennis *Grt.* (Agrotis cupida *Grt.*). Centre, N. Y.
R. (Agrotis) placida *Grt.* Lewis county, N. Y.
R. (Agrotis) variata *Grt.* Colorado

Rhynchagrotis (Agrotis) alternata *Grt.* Centre, N. Y.
R. (Agrotis) cupidissima *Grt.* New Mexico
R. (Agrotis) mirabilis *Grt.* Colorado
Adelphagrotis indeterminata *Walk.* (Agrotis innotabilis *Grt.*). Washington
A. (Eurois) prasina *Fabr.* Centre, N. Y.
Platagrotis (Agrotis) speciosa *Hübn.* Labrador
P. (Eurois) pressa *Grt.* Centre, N. Y.
P. condita *Guen.* (Agrotis trobalis *Grt.*). Centre, N. Y.
P. (Agrotis) imperita *Hübn.* Labrador
Eueretagrotis (Agrotis) sigmoides *Guen.* Centre, N. Y.
E. (Agrotis) perattenta *Grt.* Lewis county, N. Y.
E. (Agrotis) attenta *Grt.* Lewis county, N. Y.
Semiophora elimata *Grt.* (Agrotis dilucidula *Morr.*). Centre, N. Y.
S. (Agrotis) elimata *var.* badicollis *Grt.* Centre, N. Y.
S. (Agrotis) elimata *var.* janualis *Grt.* Centre, N. Y.
S. (Agrotis) opacifrons *Grt.* Lewis county, N. Y.
S. tenebrifera *Walk.* (Agrotis catherina *Grt.*). New Hampshire
Pachnobia carnea *Thunb.* Labrador
P. salicarum *Walk.* Saranac Lake, N. Y.
P. rubricosa *Fabr.* Europe
P. leucographa *Hübn.* Europe
Setagrotis (Agrotis) vernilis *Grt.* Colorado
Agrotis badinodis *Grt.* Kittery Point, Me.
A. ypsilon *Rott.* Centre, N. Y.
A. geniculata *Grt. & Rob.* Centre, N. Y.
A. polygona *Fabr.* Europe
A. signum *Fabr.* Europe
A. subrosea *Stph.* *var.* subcaerulia *Stegr.* Pomerania
A. janthina *Esp.* Europe
A. linogrisea *Schiff.* Europe
A. fimbria *Linn.* Europe
A. interjecta *Hübn.* Europe
A. augur *Fabr.* Europe
A. obscura *Brahm.* (ravida *Brahm.*). Europe
A. pronuba *Linn.* Europe
A. orbona *Hufn.* Europe
A. comes *Hübn.* Europe
A. triangulum *Hufn.* Europe
A. baja *Fabr.* Europe
A. candelarum *Stegr.* Europe
A. c-nigrum *Linn.* Pomerania
A. ditrapezium *Bkh.* Europe
A. stigmatica *Hübn.* Europe
A. xanthographa *Fabr.* Europe
A. rubi *View.* Europe
A. florida *Schmidt.* Europe
A. brunnea *Fabr.* Europe
A. primulae *Esp.* (festiva *Hübn.*). Europe
A. depuncta *Linn.* Russia
A. margaritacea *Vill.* Switzerland
A. anachoreta *Herr.-Schaef.* Russia
A. ocellina *Hübn.* Europe
A. plecta *Linn.* Europe
A. simulans *Hufn.* Eurcpe
A. lucipeta *Fabr.* Europe
A. helvetina *Boisd.* Europe
A. simplonia *Hübn.* Europe
A. latens *Hübn.* Europe
A. fimbriola *Esp.* Europe
A. forcipula *Hübn.* Europe
A. puta *Hübn.* Europe
A. putris *Linn.* Europe
A. exclamationis *Linn.* Europe
A. nigricans *Linn.* Europe
A. tritici *Linn.* Europe
A. tritici *var.* aquilina *Hübn.* Europe
A. vitta *Hübn.* Europe
A. christophi *Stegr.* Russia
A. obelisca *Hübn.* Europe
A. corticea *Hübn.* Europe
A. ypsilon *Rott.* Europe
A. segetum *Schiff.* Europe
A. trux *Hübn.* Europe
A. conspicua *Hübn.* Russia
A. vestigialis *Rott.* Europe
A. praecox *Linn.* Europe

A. prasina *Fabr.* Europe
Peridroma (Agrotis) occulta *Linn.* Europe
P. (Eurois) astricta *Morr.* Lewis county, N. Y.
P. (Agrotis) margaritosa *Haw. var.* saucia *Hübn.* Centre, N. Y.
P. (Agrotis) incivis *Guen.* Atlantic States, California
P. (Agrotis) rudens *Harv.* Texas
P. (Agrotis) simplaria *Morr.* Texas
P. digna *Morr.* (Agrotis nigrovittata *Grt.*). Texas
Noctua smithii *Snell.* (Agrotis baja *Fabr.*). Centre, N. Y.
N. (Agrotis) normaniana *Grt.* Centre, N. Y.
N. (Agrotis) bicarnea *Guen.* Lewis county, N. Y.
N. (Agrotis) conchis *Grt.* New Mexico
N. (Agrotis) c-nigrum *Linn.* Centre, N. Y.
N. (Agrotis) hospitalis *Grt.* Lewis county, N. Y.
N. jucunda *Walk.* (Agrotis perconflua *Grt.*). Centre, N. Y.
N. (Agrotis) phyllophora *Grt.* Lewis county, N. Y.
N. (Agrotis) rubifera *Grt.* Centre, N. Y.
N. oblata *Morr.* (Agrotis hilliana *Harv.*). Lewis county, N. Y.
N. (Agrotis) rava *Herr.-Schaef.* Labrador
N. (Agrotis) fennica *Tausch.* Lewis county, N. Y.
N. (Agrotis) plecta *Linn.* Albany, N. Y.
N. (Agrotis) collaris *Grt. & Rob.* Lewis county, N. Y.
N. (Agrotis) haruspica *Grt.* Lewis county, N. Y.
N. (Agrotis) sierrae *Harv.* Colorado
N. (Agrotis) clandestina *Harr.* Lewis county, N. Y.
N. (Agrotis) pyrophiloides *Harv.* California
Noctua (Agrotis) lubricans *Guen.* Oldtown, Me.
N. (Agrotis) lubricans *var.* beata *Grt.* New Mexico
Chorizagrotis (Agrotis) auxiliaris *Grt.* Kansas
Feltia (Agrotis) subgothica *Haw.* Centre, N. Y.
F. jaculifera *Guen.* (Agrotis tricosa *Lint.*). Lewis county, N. Y.
F. (Agrotis) jaculifera *var.* herilis *Grt.* Albany, N. Y.
F. (Agrotis) circumdata *Grt.* New Mexico
F. (Agrotis) gladiaria *Morr.* Kittery Point, Me.
F. (Agrotis) venerabilis *Walk.* New Berlin, N. Y.
F. (Agrotis) aeneipennis *Grt.* California
F. (Agrotis) volubilis *Harv.* Centre, N. Y.
F. (Agrotis) annexa *Treit.* Savannah, Ga.
F. (Agrotis) malefida *Guen.* Florida
Porosagrotis vetusta *Walk.* (Agrotis muraenula *Grt. & Rob.*). Centre, N. Y.
P. (Agrotis) mimallonis *Grt.* Lewis county, N. Y.
P. (Agrotis) fusca *Boisd.* Labrador
P. (Agrotis) rileyana *Morr.* Iowa
P. (Agrotis) orthogonia *Morr.* Colorado
Paragrotis (Agrotis) recula *Harv.* Oregon
P. (Agrotis) quadridentata *Grt. & Rob.* Colorado
P. (Agrotis) olivalis *Grt.* Colorado
P. (Agrotis) ridingsiana *Grt.* Colorado
P. (Agrotis) flavidens (*Sm.*). New Mexico
P. (Agrotis) brocha *Morr.* Colorado
P. (Agrotis) perpolita *Morr.* Centre, N. Y.
P. (Agrotis) fumalis *Grt.* Colorado
P. punctigera *Walk.* (Agrotis pastoralis *Grt.*). Colorado

Paragrotis (Agrotis) velleripennis *Grt.* Nebraska
P. (Agrotis) gagates *Grt.* Colorado
P. (Agrotis) scandens *Riley.* Lewis county, N. Y.
P. detersa *Walk.* (Agrotis pitychrous *Grt.*). Evans Center, N. Y.
P. (Agrotis) bostoniensis *Grt.* Centre, N. Y.
P. (Agrotis) caenis *Grt.* Colorado
P. (Agrotis) medialis *Sm.* Centre, N. Y.
P. (Agrotis) feniseca *Harv.* California
P. (Agrotis) messoria *Harr.* Schenectady, N. Y.
P. (Agrotis) friabilis *Grt.* Lewis county, N. Y.
P. (Agrotis) munis *Grt.* Colorado
P. (Agrotis) *sp.* California
P. vetusta *Walk.* (Agrotis euroides *Grt.*). Vancouver Island
P. infausta *Walk.* (Agrotis rufula *Sm.*)
P. insulsa *Walk.* (Agrotis campestris *Grt.*)
P. (Agrotis) albipennis *Grt.* Centre, N. Y.
P. (Agrotis) tessellata *Harr.* Lewis county, N. Y.
P. (Agrotis) basalis *Grt.* Colorado
P. (Agrotis gularis *Grt.*) ochrogaster *Guen.* Lewis county, N. Y.
P. (Agrotis) obeliscoides *Guen.* Centre, N. Y.
P. (Agrotis) perexcellens *Grt.* Vancouver Island
P. divergens *Walk.* (Agrotis versipellis *Grt.*). Saranac Lake, N. Y.
P. (Agrotis) redimicula *Morr.* Lewis county, N. Y.
P. (Agrotis) atrifera *Grt.* Lewis county, N. Y.
Richia (Ammoconia) chortalis *Harv.* Colorado
R. (Ammoconia) chortalis *var.* atratrix *Harv.* Colorado
R. (Ammoconia) parentalis *Grt.* New Mexico
R. (Ammoconia) parentalis *var.* decipiens *Grt.* Colorado
Ammoconia caecimacula *Fabr.* Europe
Anytus privatus *Walk.* (sculptus *Grt.*). Center, N. Y.
A. privatus (sculptus) *var.* planus *Grt.* Lewis county, N. Y.
Ufeus plicatus *Grt.* California
Mamestra discalis *Grt.* (purpurissata *Grt.*). Colorado
M. nimbosa *Guen.* Lewis county, N. Y.
M. imbrifera *Guen.* Lewis county, N. Y.
M. purpurissata *Grt.* Lewis county, N. Y.
M. meditata *Grt.* Centre, N. Y.
M. lustralis *Grt.* Lewis county, N. Y.
M. detracta *Walk.* Centre, N. Y.
M. atlantica *Grt.* Cambridge, Mass.
M. radix *Walk.* (dimmecki *Grt.*). Centre, N. Y.
M. subjuncta *Grt. & Rob.* Centre, N. Y.
M. grandis *Boisd.* Centre, N. Y.
M. trifolii *Rott.* Albany, N. Y.
M. trifolii *Rott.* (albifusa *Walk.*). Europe
M. trifolii *Rott.* (chenopodii *Fabr.*). Europe
M. rosea *Harv.* Centre, N. Y.
M. congermana *Morr.* Centre, N. Y.
M. picta *Harr.* Washington, D. C.
M. cristifera *Walk.* (lubens *Grt.*). Centre, N. Y.
M. assimilis *Morr.* Lewis county, N. Y.
M. assimilis *var. Grt.* Centre, N. Y.
M. adjuncta *Boisd.* Tiffin, O.
M. legitima *Grt.* Lewis county, N. Y.
M. lilacina *Harv.* Lewis county, N. Y.
M. goodellii *Grt.* Lewis county, N. Y.
M. renigera *Steph.* Lewis county, N. Y.
M. stricta *Walk. var.* cinnabarina *Grt.* Washington

Mamestra olivacea *Morr.* Lewis county, N. Y.
M. quadrilineata *Grt.* California
M. laudabilis *Guen.* Washington, D. C.
M. albogutta *Grt.* California
M. cuneata *Grt.* California
M. lorea *Guen.* Lewis county, N. Y.
M. vicina *Grt.* Centre, N. Y.
M. leucophaea *View.* Europe
M. advena *Fabr.* Europe
M. tincta *Brahm.* Europe
M. nebulosa *Hufn.* Europe
M. brassicae *Linn.* Europe
M. persicariae *Linn.* Europe
M. oleracea *Linn.* Europe
M. genistae *Bkh.* Europe
M. dissimilis *Knoch.* Europe
M. thalassina *Rott.* Europe
M. contigua *Vill.* Europe
M. pisi *Linn.* Europe
M. leineri *Frr. var.* pomerana *Schulz.* Europe
M. dentina *Esp.* Europe
M. marmorosa *Bkh.* Europe
M. reticulata *Vill.* Europe
M. chrysozona *Bkh.* Europe
M. serena *Fabr.* Europe
M. cappa *Hübn.* Europe
Charaeas graminis *Linn.* Europe
Epineuronia (Neuronia) popularis *Fabr.* Europe
E. (Neuronia) cespitis *Fabr.* Europe
Dianthoecia albimacula *Bkh.* Europe
D. nana *Rott.* Europe
D. compta *Fabr.* Europe
D. capsincola *Hübn.* Europe
D. cucubali *Fuessl.* Europe
D. carpophaga *Bkh.* Europe
D. carpophaga *var.* capsophila *Dup.* Europe
D. irregularis *Hufn.* Europe
Dargida (Eupsephopaectes) procinctus *Grt.* California
Morrisonia (Hadena) sectilis *Guèn.* Lewis county, N. Y.
M. sectilis *Guen. var.* vomerina *Grt.* Centre, N. Y.
M. (Mamestra) mucens *Hübn.* Savannah, Ga.
M. (Mamestra) confusa *Hübn.* Cambridge, Mass.
Xylomiges rubrica *Harv.* California
X. patalis *Grt.* Vancouver Island
X. tabulata *Grt.* Lewis county, N.Y.
X. conspicillaris *Linn.* Europe
Scotogramma umbrosa *Smith.* Colorado
Ulolonche (Taeniocampa) modesta *Morr.* Centre, N. Y.
U. (Orthosia) disticha *Morr.* Texas
Anarta melanopa *Thunb.* Labrador
A. richardsoni *Curt.* Labrador
A. myrtilli *Linn.* Europe
A. melaleuca *Thunb.* Europe
Nephelodes minians *Guen.* Lewis county, N. Y.
N. minians *var.* violans *Guen.* Lewis county, N. Y.
Heliophila (Leucania) unipuncta *Haw.* Centre, N. Y.
H. (Leucania) pseudargyria *Guen.* Centre, N. Y.
H. luteopallens *Smith* (Leucania pallens *Guen.*). Centre, N. Y.
H. rubripennis *Grt. & Rob.* Texas
H. (Leucania) albilinea *Hübn.* Albany, N. Y.
H. ligata *Grt.* Florida
H. insueta *Guen.* (Leucania adonea *Grt.*). Lewis county, N. Y.
H. multilinea *Walk.* (Leucania lapidaria *Grt.*). Centre, N. Y.
H. (Leucania) commoides *Guen.* Lewis county, N. Y.
H. (Leucania) phragmitidicola *Guen.* Centre, N. Y.
Meliana flammea *Curt.* Russia
Sesamia cretica *Led.* Europe
Leucania impudens *Hübn.* Silesia
L. impura *Hübn.* Europe
L. pallens *Linn.* Europe
L. obsoleta *Hübn.* Europe
L. comma *Linn.* Europe
L. l-album *Linn.* Europe
L. vitellina *Hübn.* Dalmatia
L. conigera *Fabr.* Europe

Leucania albipuncta *Fabr.* France
L. lythargyria *Esp.* Europe
L. turca *Linn.* Europe
Mythimna imbecilla *Fabr.* Europe
Grammesia trigrammica *Hufn.* Europe
Zosteropoda hirtipes *Grt.* California
Trichorthosia parallela *Grt.* New Mexico
Orthodes crenulata *Butler.* Lewis county, N. Y.
O. cynica *Guen.* Colorado; Centre, N. Y.
O. cynica *var. Grt.* Centre, N. Y.
O. (Taeniocampa) puerilis *Grt.* California
O. (Taeniocampa) agrotiformis *Grt.* New Mexico
Himella contrahens *Walk.* (Taeniocampa thecata *Morr.*). Saranac Lake, N. Y.
Perigrapha cincta *Fabr.* Europe
Taeniocampa gothica *Linn.* Europe
T. miniosa *Fabr.* Europe
T. pulverulenta *Esp.* (cruda *Treit.*). Europe
T. populeti *Treit.* Europe
T. stabilis *View.* Europe
T. incerta *Hufn.* Europe
T. opima *Hübn.* Europe
T. gracilis *Fabr.* Europe
T. munda *Esp.* Europe
Panolis griseovariegata *Goeze* (piniperda *Panz.*). Europe
Crocigrapha normani *Grt.* Centre, N. Y.
Graphiphora (Taeniocampa) rufula *Grt.* California
G. (Taeniocampa) oviducta *Guen.* Centre, N. Y.
G. (Mamestra) vindemialis *Guen.* Centre, N. Y.
G. (Taeniocampa) alia *Guen.* Tiffin, O.
G. (Taeniocampa) subterminata *Sm.* South Abington, Mass.
G. (Agrotis) planalis *Grt.* New Mexico
Dyschorista fissipuncta *Hew.* Europe
Plastenis retusa *Linn.* Europe
Cirrhoedia ambusta *Fabr.* Europe
C. xerampelina *Hübn.* England
Tricholita signata *Walk.* (semiaperta *Morr.*). Kittery Point, Me.
Xylina disposita *Morr.* Centre, N. Y.
X. petulca *Grt.* Centre, N. Y.
X. hemina *Grt.* Lewis county, N. Y.
X. antennata *Walk.* Centre, N. Y.
X. laticinerea *Grt.* Centre, N. Y.
X. grotei *Riley* (cinerosa *Grt.*). Centre, N. Y.
X. ferrealis *Grt.* Lewis county, N. Y.
X. signosa *Walk.* Centre, N. Y.
X. bethunei *Grt.* Lewis county; Centre, N. Y.
X. semiusta *Grt.* Centre, N. Y.
X. fagina *Morr.* Centre, N. Y.
X. georgii *Grt.* Lewis county, N. Y.
X. unimoda *Lint.* Centre, N. Y.
X. tepida *Grt.* Centre, N. Y.
X. baileyi *Grt.* New York
X. querquera *Grt.* Centre, N. Y.
X. lepida *Lint.* Centre, N. Y.
X. thaxteri *Grt.* (cambda *Grt.*). Centre, N. Y.
X. pexata *Grt.* Centre, N. Y.
X. capax *Grt. & Rob.* Centre, N. Y.
X. semibrunnea *Hew.* Clarente, France
X. socia *Rott.* Europe
X. furcifera *Hufn.* Europe
X. ingrica *Herr.-Schaef.* Norway
X. ornitopus *Rott.* Europe
Litholomia napaea *Morr.* Orono, Me.
Calocampa nupera *Lint.* Centre, N. Y.
C. thoracica *Put.-Cram.* Saranac Lake, N. Y.
C. cineritia *Grt.* Saranac Lake, N. Y.
C. curvimacula *Morr.* Centre, N. Y.
C. vetusta *Hübn.* Europe
C. exoleta *Linn.* Europe
C. solidaginis *Hübn.* Europe
Cucullia convexipennis *Grt. & Rob.* Lewis county, N. Y.
C. montanae *Grt.* Colorado
C. postera *Guen.* Adirondack mts, N. Y.
C. asteroides *Guen.* Albany, N. Y.

Cucullia speyeri *Lint.* Albany, N. Y.
C. intermedia *Spey.* Lewis county, N. Y.
C. serraticornis *Lint.* Colorado
C. verbasci *Linn.* Holland
C. scrophulariae *Capieux.* Holland
C. lychnitis *Rambur.* Europe
C. thapsiphaga *Treit.* Europe
C. blattariae *Esp.* Europe
C. asteris *Schiff.* Europe
C. lactea *Fabr.* Russia
C. balsamitae *Boisd.* Russia
C. tanaceti *Schiff.* Clarente, France
C. umbratica *Linn.* Europe
C. lucifuga *Hübn.* Europe
C. lactucae *Esp.* Europe
C. chamomillae *Schiff.* Europe
C. fraudatrix *Ev.* Europe
C. scopariae *Dorf.* Europe
C. artemisiae *Hufn.* Europe
C. absinthii *Linn.* Europe
C. argentea *Hufn.* Europe
C. argentina *Fabr.* Europe
Eutelia (Eurphipia) adulatrix *Hübn.* Europe
Bellura gortynides *Walk.* (Arzama densa *Walk.*). Hamilton, Ont.
B. (Arzama) diffusa *Grt.* Hamilton, Ont.
Nonagria subflava *Grt.* Kittery Point, Me.
N. cannae *Och.* Europe
N. sparganii *Esp.* Europe
N. typhae *Thunb.* (arundinis *Fabr.*). Hungary
N. geminipuncta *Hatch.* Europe
Ommatostola lintneri *Grt.* Centre, N. Y.
Achatodes zeae *Harr.* Lewis county, N. Y.
Hydroecia micacea *Esp.* Europe
Apamea testacea *Hübn.* Europe
Gortyna velata *Walk.* (Apamea sera *Grt. & Rob.*). Lewis county, N. Y.
G. (Apamea) nictitans *Bkh.* Lewis county, N. Y.
G. (Apamea) immanis *Guen.* Centre, N. Y.
G. ochracea *Hübn.* Thuringia
Papaipema (Gortyna) purpurifascia *Grt. & Rob.* Centre, N. Y.
P. (Gortyna) nitela *Guen.* Beverly, Mass.
P. (Gortyna) nitela *var.* nebris *Guen.* South Abington, Mass.
P. (Gortyna) cataphracta *Grt.* Hamilton, Ont.
P. (Gortyna) impecuniosa *Grt.* Centre, N. Y.
P. (Gortyna) rutila *Guen.* Mt Kisco, N. Y.
Pyrrhia (Chariclea) umbra *Hufn.* Russia
P. umbra *var.* exprimens *Walk.* Centre, N. Y.; Lewis county, N. Y.
Chariclea delphinii *Linn.* Russia
Xanthia flavago *Fabr.* (lutea *Strom.*). Centre, N. Y.; Germany
X. citrago *Linn.* Europe
X. sulphurago *Fabr.* Europe
X. aurago *Fabr.* Germany
X. fulvago *Linn.* Europe
X. gilvago *Esp.* Europe
X. ocellaris *Bkh.* France
Hoporina croceago *Fabr.* Europe
Jodia rufago *Hübn.* Washington, D. C.
Brotolomia iris *Guen.* Centre, N. Y.
Trigonophora periculosa *Guen.* Centre, N. Y.
T. periculosa *var.* v-brunneum *Grt.* Centre, N. Y.
T. flammea *Esp.* Europe
Conservula anodonta *Guen.* Cambridge, Mass.
Eucirroedia pampina *Guen.* Centre, N. Y.
Scoliopteryx libatrix *Linn.* Lewis county, N. Y.; Europe
Tapinostola elymi *Treit.* Europe
Fagitana littera *Guen.* (Pseudolimacodes niveicostatus *Grt.*). Centre, N. Y.
Cosmia paleacea *Esp.* (infumata *Grt.*). Centre, N. Y.; Europe
C. abluta *Hübn.* Europe
Orthosia purpurea *Grt.* (crispa *Harv.*). Dallas, Or.
O. ralla *Grt.* Lewis county, N. Y.

Orthosia bicolorago *Guen.* (*var.* ferruginoides *Guen.*). Centre, N. Y.
O. euroa *Grt. & Rob.* Centre, N. Y.
O. conradi *Grt.* Colorado
O. helva *Grt.* Centre, N. Y.
O. lutosa *Andrews.* Schenectady, N. Y.
O. ruticilla *Esp.* Holland
O. lota *Clerc.* Hungary
O. macilenta *Hübn.* Europe
O. circellaris *Hufn.* Europe
O. ferrugineoides *Guen.* Europe
O. helvola *Linn.* (rufina *Linn.*). Europe
O. pistacina *Fabr.* France
O. nitida *Fabr.* Europe
O. laevis *Hübn.* Europe
O. litura *Linn.* Europe
Parastichtis discivaria *Walk.* (gentilis *Grt.*). Centre, N. Y.
P. discivaria *var.* perbellis *Grt.* Lewis county, N. Y.
Scopelosoma indirecta *Walk.* (graefiana *Grt.*). Corning, N. Y.
S. moffatiana *Grt.* Hamilton, Ont.
S. pettiti *Grt.* Hamilton, Ont.
S. ceromatica *Grt.* Hamilton, Ont.
S. tristigmata *Grt.* Centre, N. Y.
S. walkeri *Grt.* Corning, N. Y.
S. sidus *Guen.* (vinulenta *Grt.*). Hamilton, Ont.
S. morrisoni *Grt.* Hamilton, Ont.
S. devia *Grt.* Hamilton, Ont.
S. satellitia *Linn.* Europe
Orrhodia fragariae *Esp.* Europe
O. erythrocephala *Fabr.* Europe
O. veronicae *Hübn.* Europe
O. vau punctatum *Esp.* Thuringia
O. vaccinii *Linn.* Europe
O. ligula *Esp.* Europe
O. rubiginea *Fabr.* Europe
Glaea (Epiglaea) sericea *Morr.* Centre, N. Y.
Epiglaea pastillicans *Morr.* Centre, N. Y.
E. tremula *Harv.* Texas
E. apiata *Grt.* Centre, N. Y.
E. decliva *Grt.* Centre, N. Y.
Homoglaea hircina *Morr.* Centre, N. Y.
H. carnosa *Grt.* Centre, N. Y.
Calymnia orina *Guen.* Hamilton, Ont.
C. pyralina *View.* Europe
C. affinis *Linn.* Europe
C. diffinis *Linn.* Europe
C. trapezina *Grt.* Europe
Zotheca tranquilla *Grt.* California
Ipimorpha pleonectusa *Grt.* Hamilton, Ont.
Mesogona oxalina *Hübn.* Europe
M. acetosellae *Fabr.* Europe
Dicycla oo *Linn.* Dalmatia
Grotella dis *Grt.* Las Vegas, N. M.
Nycterophaeta (Cucullia) luna *Morr.* Colorado
Copablepharon album *Harv.* Colorado
C. absidum *Harv.* Colorado
Heliothis armiger *Hübn.* Tiffin, O.
H. phlogophagus *Grt. & Rob.* Utah, California
H. cognata *Frr.* Europe
H. cardui *Hübn.* Europe
H. purpurascens *Tausch.* Russia
H. dipsacea *Linn.* Europe
H. scutosa *Schiff.* Europe
H. peltigera *Schiff.* Russia
H. armigera *Hübn.* Dalmatia
H. incarnata *Frr.* Russia
Mycteroplus puniceago *Boisd.* Russia
Rhodophora (Alaria) gaurae *Sm. & Abb.* Texas
R. florida *Guen.* Texas
R. (Oxylos) citrinellus *Grt. & Rob.* Texas
Porrima (Heliothis) regia *Streck.* Kansas
Eupanychis (Heliothis) spinosae *Guen.* ? Atlantic States
Schinia (Tricopis) chrysellus *Grt.* Texas
S. unimacula *Sm.* Colorado
S. acutilinea *Grt.* (Lygranthoecia separata *Grt.*). Colorado
S. (Lygranthoecia) lynx *Guen.* Centre, N. Y.
S. (Tamila) tertia *Grt.* Texas
S. (Lygranthoecia) jaguarina *Guen.* Nebraska

Schinia arcifera *Guen.* (Lygranthoecia spraguei *Grt.*). Brooklyn, N. Y.
S. packardii *Grt.* (Anthoecia nobilis *Grt.*). Colorado
S. (Lygranthoecia) thoreaui *Grt. & Rob.* ? Southern States
S. marginata *Haw.* (Lygranthoecia rivulosa *Guen.*). Mt Kisco, N. Y.
S. (Lygranthoecia) brevis *Grt.* Albany, N. Y.
Dasyspoudaea (Heliothis) lucens *Morr.* Nebraska
D. (Tamila) meadii *Grt.* Colorado
Pseudotamila (Tamila) vanella *Grt.* Nevada
Melicleptria (Adonisea) pulchripennis *Grt.* Southern California
M. villosa *Grt.* New Mexico
M. villosa *var.* persimilis *Grt.* California
Heliolonche modicella *Grt.* California
Heliodes rupicola *Hübn.* Hungary
Omia cymbalariae *Hübn.* Russia
Xanthodes graellsii *Feist.* Catalonia
Xanthothrix ranunculi *Hy. Edw.* California
Axenus arvalis *Grt.* California
Heliaca (Melicleptria) diminutiva *Grt.* California
H. tenebrata *Scop.* Europe
Psychomorpha epimenis *Dru.* Kansas
Euthisanotia (Eudryas) unio *Hübn.* Ohio
E. (Eudryas) grata *Fabr.* New York
E. timais *Hübn.* Jamaica
Noropsis (Euglyphia) hieroglyphica *Cramer.* Jamaica
Cirrhophanus (Chariclea) triangulifer *Grt.* Tiffin, O.
Basilodes pepita *Guen.* Texas
B. chrysopis *Grt.* New Mexico
Stiria rugifrons *Grt.* Colorado
Stibadium spumosum *Grt.* Kansas
Plagiomimicus pityochromus *Grt.* Colorado
Plusiodonta compressipalpis *Guen.* Texas
Calpe canadensis *Beth.* Centre, N.Y.
C. capucina *Esp.* Schwerin
Panchrysia (Deva) purpurigera *Walk.* Orono, Me.
Polychrysia (Plusia) formosa *Grt.* Lewis county, N. Y.
Plusia aerea *Hübn.* Centre, N. Y.
P. aeroides *Grt.* Lewis county, N. Y.
P. balluca *Geyer.* Orono, Me.
P. c-aureum *Knoch.* Europe
P. deaurata *Esp.* Europe
P. moneta *Fabr.* Europe
P. cheiranti *Tausch.* Europe
P. variabilis *Piller* (illustris *Fabr.*). Europe
P. modesta *Hübn.* Hungary
P. consona *Fabr.* Europe
P. chrysitis *Fabr.* Europe
P. chryson *Esp.* Europe
P. bractea *Fabr.* Schwerin
P. festucae *Linn.* Europe
P. pulchrina *Hew.* Europe
P. jota *Linn.* Europe
P. gamma *Linn.* Europe
P. circumflexa *Linn.* Russia
P. daubei *Boisd.* Europe
P. ni *Hübn.* Russia
P. interrogationis *Linn.* Europe
P. hochenwarthi *Hoch.* Europe
P. devergens *Hübn.* Europe
Euchalcia (Plusia) contexta *Grt.* Albany, N. Y.
E. (Plusia) festuca *Linn. var.* putnami *Grt.* Lewis county, N. Y.
E. venusta *Walk.* (Plusia striatella *Grt.*). Orono, Me.
Eosphoropteryx (Plusia) thyatiroides *Guen.* Lewis county, N. Y.
Autographa (Plusia) mappa *Grt. & Rob.* Adirondack mts, N. Y.
A. (Plusia) bimaculata *Steph.* Orono, Me.
A. (Plusia) biloba *Steph.* New Hampshire
A. (Plusia) verruca *Fabr.* Savannah, Ga.
A. rogationis *Guen.* (Plusia dyaus *Grt.*). Indian river, Fla.
A. (Plusia) precationis *Guen.* Albany, N. Y.

Autographa (Plusia) gamma *Linn.* *var.* californica *Speyer*. California
A. (Plusia) ou *Guen.* Texas
A. brassicae *Riley* (Plusia ni *Hübn.*). Centre, N. Y.
A. (Plusia) octoscripta *Grt.* Lewis county, N. Y.
A. rectangula *Kirby* (Plusia mortuorum *Guen.*). Lewis county, N. Y.
A. (Plusia) u-aureum *Guen.* Adirondack mts, N. Y.
A. selecta *Walk.* (Plusia viridisignata *Grt.*). Lewis county, N. Y.
A. (Plusia) epigaea *Grt.* Lewis county, N. Y.
A. (Plusia) ampla *Walk.* Adirondack mts, N. Y.
A. (Plusia) falcigera *Kirby var.* simplex *Guen.* Centre, N. Y.
A. (Plusia) pasiphaeia *Grt.* Rockledge, Fla.
A. (Plusia) sackeni *Grt.* Santa Fé Canyon, N. M.
Syngrapha (Plusia) hochenwarthi *Hoch.* Colorado
Abrostola urentis *Guen.* Tiffin, O.
A. triplasia *Linn.* Europe
A. (Plusia) asclepiadis *Schiff.* Europe
A. tripartita *Hufn.* Holland
Ogdoconta (Telesilla) cinereola *Guen.* Centre, N. Y.
Telesilla amethystina *Hübn.* Europe
Paectes (Ingura) delineata *Guen.* ? Atlantic States
P. pygmaea *Hübn.* (Ingura praepilata *Grt.*). Texas
P. (Ingura) occulatrix *Guen.* Brooklyn, N. Y.
Marasmalus inficita *Walk.* (histrio *Grt.*). ? Atlantic States
Amyna orbica *Morr.* (Chytoryza tecta *Grt.*). Texas
Alabama (Aletia) argillacea *Hübn.* Centre, N. Y.
Anomis erosa *Hübn.* Jamaica
Scolecocampa liburna *Geyer.* New York
Cilla distema *Grt.* Texas
Amolita fessa *Grt.* Mt Kisco, N. Y.
Rivula propinqualis *Guen.* Centre, N. Y.
Doryodes bistriaris *Geyer* (acutaria *Herr.-Schaef.*). Long Island
Phiprosopus callitrichoides *Grt.* Texas
Annaphila diva *Grt.* California
A. decia *Grt.* California
A. depicta *Grt.* California
Eustrotia (Erastria) albidula *Guen.* Lewis county, N. Y.
E. (Erastria) concinnimacula *Guen.* Albany, N. Y.
E. (Erastria) synochitis *Grt. & Rob.* Albany, N. Y.
E. (Erastria) muscoscula *Guen.* Centre, N. Y.
E. (Erastria) apicosa *Haw.* Centre, N. Y.
E. (Erastria) carneola *Guen.* Centre, N. Y.
E. (Erastria) dividua *Grt.* Texas
Erastria argentula *Hübn.* Europe
E. uncula *Clerck.* Europe
E. pusilla *View.* Europe
E. deceptoria *Scop.* Europe
E. fasciana *Linn.* Europe
Galgula hepara *Guen.* Centre, N. Y.
G. hepara *var.* partita *Guen.* (subpartita *Guen.*). Centre, N. Y.
Lithacodia bellicula *Hübn.* Long Island
Prothymia rhodarialis *Walk.* (coccineifascia *Grt.*). Massachusetts
P. viridaria *Clerck.* Europe
Emmelia trabealis *Scop.* (Agrophila sulphurea *Linn.*). Europe
Exyra rolandiana *Grt.* Massachusetts
Xanthoptera nigrofimbria *Guen.* Rockledge, Fla.
X. semiflava *Guen.* Texas
Eublemma (Thalpochares) arcuinna *Hübn.* Europe
Thalpochares dardouini *Boisd.* Europe
T. respersa *Hübn.* Europe
T. chlorotica *Led.* Russia
T. concinnula *Boisd.* Russia
T. communimacula *Hübn.* Europe
T. rosea *Hübn.* Europe

Thalpochares purpurina *Hübn.* Hungary
T. paula *Hübn.* Europe
Metoponia obtusa *Herr.-Schaef.* ? South Atlantic States
Chamyris cerintha *Treit.* Lewis county, N. Y.
Therasea (Tarache) angustipennis *Grt.* Colorado
Phlogophora (Habrintis) scita *Hübn.* Russia
Brotolomia meticulosa *Linn.* Europe
Mania maura *Linn.* Europe
Naenia typica *Linn.* Europe
Tarache flavipennis *Grt.* California
T. (Acontia) lactipennis *Harv.* Texas
T. (Acontia) biplaga *Guen.* Texas
T. (Acontia) aprica *Hübn.* Texas
T. (Acontia) erastrioides *Guen.* Texas
T. (Acontia) candefacta *Hübn.* Centre, N. Y.
Acontia lucida *Hufn.* (solaris *Esp.*). Europe
A. luctuosa *Esp.* Europe
Spragueia leo *Guen.* Savannah, Ga.
S. dama *Guen.* Savannah, Ga.
Cloantha hyperici *Fabr.* Europe
C. polyodon *Clerck.* Europe
C. radiosa *Esp.* Europe
Callopistria (Eriopus) floridensis *Guen.* Florida
C. (Eriopus) purpureofasciata *Piller.* Europe
C. (Eriopus) latreillei *Dup.* Dalmatia
Polyphaenis sericata *Esp.* Europe
Trachea atriplicis *Linn.* Europe
Metathorasa (Herrichia) monitifera *Guen.* Lewis county, N. Y.
Euherrichia (Herrichia) mollissima *Guen.* Centre, N. Y.
Pangrapta decoralis *Hübn.* Lewis county, N. Y.
Hyamia (Spargaloma) sexpunctata *Grt.* Centre, N. Y.
H. perditalis *Walk.* (Spargaloma umbrifascia *Grt.*). Kansas

Homopyralis discalis *Grt.* Centre, N. Y.
H. contracta *Walk.* (tactus *Grt.*). Lewis county, N. Y.
H. tantillus *Grt.* Rockledge, Fla.
Hypsoropha hormos *Hübn.* Georgia
Hyblaea puera *Cram.* Jamaica
Drasteria erechtea *Hübn.* Centre, N. Y.
D. caerulea *Grt.* California
Anophia leucomelas *Linn.* Europe
Aedia funesta *Esp.* Europe
Catephia alchymista *Schiff.* Hungary
Pseudophia lunaris *Schiff.* Europe
P. tirhaca *Cram.* Europe
Caenurgia (Litosea) convalescens *Guen.* Atlantic States
Euclidia cuspidea *Hübn.* Hamilton, Ont.
E. triquetra *Fabr.* Hungary
E. mi *Clerck.* Europe
E. glyphica *Linn.* Europe
Panula inconstans *Guen.* Texas
Meliopotis nigrescens *Grt. & Rob.* Texas
M. pallescens *Grt. & Rob.* Texas
M. (Bolina) limbolaris *Geyer.* Hamilton, Ont.
M. jucunda *Hübn.* Savannah, Ga.
Cirrhobolina deducta *Morr.* Texas
C. mexicana *Behr.* Texas
Syneda graphica *Hübn.* ? Atlantic States
S. adumbrata *Behr.* Colorado
S. ingeniculata *Morr.* Texas
S. howlandii *Grt.* Colorado
Catocala epione *Dru.* Kansas
C. agrippina *Streck.* Texas
C. lacrymosa *Guen.* Dallas, Tex.
C. lacrymosa *var.* evelina *French.* Saranac Lake, N. Y.
C. viduata *Guen.* Texas
C. vidua *Sm. & Abb.* (desperata *Guen.*). New York city; Tiffin, O.
C. retecta *Grt.* Hamilton, Ont.
C. flebilis *Grt.* Albany, N. Y.
C. robinsonii *Grt.* New York city; Carbondale, Ill.

Catocala obscura *Streck.* New York city; Carbondale, Ill.
C. residua *Grt.* Tiffin, O.
C. insolabilis *Guen.* Ohio
C. angusi *Grt.* New York city
C. angusi *var.* lucetta *Hy. Edw.* Carbondale, Ill.
C. judith *Streck.* (levettei *Grt.*). New York city
C. tristis *Edw.* New York city
C. relicta *Walk.* Centre, N. Y.
C. relicta *var.* bianca *Hy. Edw.* Centre, N. Y.
C. relicta *var.* phryne *Hy. Edw.* Centre, N. Y.
C. cara *Guen.* Albany, N. Y.
C. cara *var.* silvia *Hy. Edw.* Carbondale, Ill.
C. cara *var.* carissima *Hulst.* Florida
C. amatrix *Hübn.* Albany, N. Y.
C. amatrix *var.* murus *Walk.* Centre, N. Y.
C. marmorata *Edw.* California
C. concumbens *Walk.* Centre, N. Y.
C. concumbens *var.* hillii *Grt.* Centre, N. Y.
C. californica *Edw.* California
C. californica *var.* perdita *Hy. Edw.* California
C. luciana *Hy. Edw.* Nebraska
C. walshii *Edw.* Texas
C. stretchii *Behr.* California
C. semirelicta *Grt.* Colorado
C. unijuga *Walk.* Lewis county, N. Y.
C. meskei *Grt.* Albany, N. Y.
C. mariana *Hy. Edw.* California
C. mariana *var.* francesca *Hy. Edw.* California
C. grotiana *Bailey.* Colorado
C. hermia *Hy. Edw.* Colorado
C. briseis *Edw.* Lewis county, N. Y.
C. faustina *Streck.* Utah
C. irene *Behr.* California
C. irene *var.* virgilia *Hy. Edw.* California
C. parta *Guen.* Lewis county, N. Y.
C. coccinata *Grt.* Wisconsin
C. circe *Streck.* Texas
C. aholibah *Streck.* California
C. verrilliana *Grt. var.* ophelia *Hy. Edw.* New Mexico
C. ultronia *Guen.* Lewis county, N. Y.
C. ilia *Cram.* Michigan
C. ilia *var.* uxor *Guen.* Coldwater, Mich.
C. innubens *Guen.* Kansas
C. innubens *var.* scintillans *Grt. & Rob.* Virginia
C. nebulosa *Edw.* New York city
C. piatrix *Grt.* Kansas
C. neogama *Sm. & Abb.* Centre, N. Y.
C. subnata *Grt.* Lewis county, N. Y.
C. cerogama *Guen.* Centre, N. Y.
C. cerogama *var.* bunkeri *Grt.* Lewis county, N. Y.
C. palaeogama *Guen.* Kansas
C. consors *Guen.* Douglas county, Kan.
C. muliercula *Guen.* New York city
C. delilah *Streck.* (adoptiva *Grt.*). Texas
C. illecta *Walk.* Dayton, O.
C. serena *Edw.* New York city
C. antinympha *Hübn.* Centre, N. Y.
C. badia *Grt. & Rob.* Kittery Point, Me.
C. coelebs *Grt.* Lewis county, N. Y.
C. habilis *Grt.* Albany, N. Y.
C. clintonii *Grt.* Atlantic States
C. abbreviatella *Grt.* Douglas county, Kan.
C. whitneyi *Dodge.* Douglas county, Kan.
C. nuptialis *Walk.* Schenectady, N. Y.
C. polygama *Guen.* Lewis county, N. Y.
C. polygama *var.* crataegi *Saund.* Maine
C. polygama *var.* mira *Grt.* Douglas county, Kan.
C. pretiosa *Lint.* Albany, N. Y.
C. amasia *Sm. & Abb.* Florida
C. cordelia *Hy. Edw.* Douglas county, Kan.
C. similis *Edw.* (formula *Grt. & Rob.*). Texas

Catocala similis *var.* aholah *Streck.* Georgiana, Fla.
C. fratercula *Grt. & Rob.* Texas
C. fratercula *var.* atarah *Streck.* Rockledge, Fla.
C. praeclara *Grt. & Rob.* Lewis county, N. Y.
C. gracilis *Edw.* Centre, N. Y.
C. amica *Hübn.* (androphila *Guen.*). Albany, N. Y.
C. amica *var.* lineella *Grt.* Albany, N. Y.
C. fraxini *Linn.* Europe
C. electa *Bkh.* Hungary
C. elocata *Esp.* Hungary
C. puerpera *Giorna.* Hungary
C. nupta *Linn.* Holland
C. dilecta *Hübn.* Dalmatia
C. sponsa *Linn.* Europe
C. promissa *Esp.* Europe
C. conjuncta *Esp.* Europe
C. pacta *Linn.* Europe
C. hymenaea *Schiff.* Europe
C. fulminea *Scop.* (paranympha *Esp.*) Hungary
C. conversa *Esp.* Europe
C. conversa *var.* agamos *Hübn.* Europe
C. diversa *Hübn.* Dalmatia
C. nymphagoga *Esp.* Dalmatia
Allotria elonympha *Hübn.* Albany, N. Y.
Andrewsia messalina *Guen.* (belfragiana *Harv.*). Douglas county, Kan.
Euparthenos (Parthenos) nubilis *Hübn.* Albany, N. Y.
Apopestes (Spintherops) spectrum *Esp.* Europe
Exophyla rectangularis *Hübn.* Europe
Hypocala andremona *Cram.* (hilli *Lint.*). Centre, N. Y.
Litocala sexsignata *Harv.* Arizona
Toxocampa victoria *Grt.* Las Vegas, N. M.
T. pastinum *Treit.* Europe
T. craccae *Fabr.* Dalmatia
T. limosa *Treit.* Hungary
Phoberia atomaris *Hübn.* Washington, D. C.
Siavana repanda *Walk.* (Harveya auripennis *Grt.*). Florida
Panapoda rufimargo *Hübn.* Albany, N. Y.
P. rufimargo *var.* carneicosta *Guen.* Douglas county, Kan.
Parallelia bistriaris *Hübn.* Centre, N. Y.
Agnomonia anilis *Dru.* Douglas county, Kan.
Remigia repanda *Fabr.* (latipes *Guen.*). Rockledge, Fla.
R. repanda *Fabr.* (hexastylus *Harv.*). Kansas
Leucanitis stolida *Fabr.* Europe
Grammodes algira *Linn.* Dalmatia
G. geometrica *Fabr.* (bifasciata *Petag.*). Europe
Poaphila quadrifilaris *Hübn.* Centre, N. Y.
Phurys vinculum *Guen.* Rockledge, Fla.
Celiptera frustulum *Guen.* Mt Kisco, N. Y.
C. bucetum *Grt.* Las Vegas, N. M.
Anticarsia gemmatilis *Hübn.* Wisconsin
Strenoloma lunilinea *Grt.* Kansas
Campometra amella *Guen.* (Homoptera stylobata *Harv.*). Texas
C. (Homoptera) mima *Harv.* Texas
Trama detrahens *Walk.* (arrosa *Harv.*). Douglas county, Kan.
T. hinna *Geyer.* Archer, Fla.
Matigramma pulverilinea *Grt.* Texas
M. pulversoa *Walk.* (laena *Harv.*). Texas
Zale horrida *Hübn.* Centre, N. Y.
Selenis monotropa *Grt.* Texas
Pheocyma lunifera *Hübn.* Texas
P. umbrina *Grt.* Arizona
Ypsia undularis *Dru.* Centre, N. Y.
Y. undularis *var.* aeruginosa *Guen.* Centre, N. Y.
Pseudanthroecia coracias *Guen.* Las Vegas, N. M.
Homoptera lunata *Dru.* Albany, N. Y.
H. lunata *var.* edusa *Dru.* Centre, N. Y.
H. rubi *Hy. Edw.* Arizona

Homoptera minerea *Guen.* Centre, N. Y.
H. calycanthata *Sm. & Abb.* Centre, N. Y.
H. edusina *Harv.* Texas
H. edusina *var.* atritincta *Harv.* Texas
H. penna *Morr.* Douglas county, Kan.
H. unilineata *Grt.* Centre, N. Y.
H. obliqua *Guen.* Centre, N. Y.
H. duplicata *Beth.* Centre, N. Y.
H. benesignata *Harv.* Centre, N. Y.
Erebus odora *Linn.* Cuba
E. hercyna *Dru.* Brazil
E. strix *Linn.* Brazil
Thysania zenobia *Cram.* Jamaica
Epizeuxis americalis *Guen.* Centre, N. Y.
E. aemula *Hübn.* Centre, N. Y.
E. (Pseudoglossa) lubricalis *Geyer.* Lewis county, N. Y.
E. (Pseudoglossa) denticulalis *Harv.* Kansas
E. rotundalis *Walk.* (borealis *Sm.*). Centre, N. Y.
E. (Helia) calvaria *Fabr.* Europe
Zanclognatha laevigata *Grt.* Atlantic States
Z. (Pityolita) pedipilalis *Guen.* Centre, N. Y.
Z. cruralis *Guen.* Adirondacks, N. Y.
Z. protumnusalis *Walk.* (minamalis *Grt.*). Rockledge, Fla.
Z. marcidilinea *Grt.* Albany, N. Y.
Z. (Megachyta) lituralis *Hübn.* Centre, N. Y.
Z. theralis *Walk.* (Megachyta deceptricalis *Zell.*). Hamilton, Ont.
Z. (Megachyta) inconspicualis *Grt.* Adirondack mts, N. Y.
Z. tarsiplumalis *Hübn.* Europe
Z. tarsicrinalis *Knoch.* Europe
Z. emortualis *Schiff.* Europe
Herminia tentacularia *Linn.* Russia
Hormisa absorptalis *Walk.* (Litognatha nubilifascia *Grt.*). Lewis county, N. Y.
Philometra metonalis *Walk.* (longilabris *Grt.*). Lewis county, N. Y.
P. eumelusalis *Walk.* (serraticornis *Grt.*). Centre, N. Y.
Chytolita morbidalis *Guen.* Ohio
C. morbidalis *var.* petrealis *Grt.* Centre, N. Y.
Renia salusalis *Walk.* (brevirostralis *Grt.*). Rockledge, Fla.
R. discoloralis *Guen.* Mt Kisco, N. Y.
R. sobrialis *Walk. var.* larvalis *Grt.* Archer, Fla.
R. clitosalis *Walk.* (centralis *Grt.*). Rockledge, Fla.
R. factiosalis *Walk.* (plenilinealis *Grt.*). Centre, N. Y.
R. flavipunctalis *Geyer* (belfragei *Grt.*). Lewis county, N. Y.
Bleptina caradrinalis *Guen.* Centre, N. Y.
Pechipogon barbalis *Clerck.* Europe
Tetanolita mynesalis *Walk.* (lixalis *Grt.*). Rockledge, Fla.
Heterogramma pyramusalis *Walk.* (Phalaenophana rurigena *Grt.*). Centre, N. Y.
Gaberasa ambigualis *Walk.* Eulinternia bifidalis *Grt.*). Centre, N. Y.
Palthis angulalis *Hübn.* Adirondack mts, N. Y.
P. asopialis *Guen.* Rockledge, Fla.
Capis curvata *Grt.* Mt Kisco, N. Y.
Salia interpuncta *Grt.* Centre, N. Y.
Lomanaltes eductalis *Walk.* (laetullus *Grt.*). Lewis county, N. Y.
Bomolocha manalis *Walk.* Mt Kisco, N. Y.
B baltimoralis *Guen.* Adirondack mts, N. Y.
B. albalienalis *Walk.* Centre, N. Y.
B. madefactalis *Guen.* (Macrohypena profecta *Grt.*). Hamilton, Ont.
B. edictalis *Walk.* (Meghypena vellifera *Grt.*). Lewis county, N. Y.
B. fontis *Thunb.* Germany
Plathypena scabra *Fabr.* Centre, N. Y.
Hypena humuli *Harr.* (evanidalis *Rob.*). Albany, N. Y.
H. proboscidalis *Linn.* Europe
H. palpalis *Hübn.* Europe
H. rostralis *Linn.* Europe
H. lividalis *Hübn.* Europe

Nycteolidae

Nycteola (Sarrothripus) revayana *Scop.* Lewis county, N. Y.

Pericopidae

Gnophaela latipennis *Boisd.* (hofferi *Grt. & Rob.*). Colorado
G. latipennis *var.* vermiculata *Grt. & Rob.* Colorado
Flavinia dichroa *Pertg.* Rio de Janeiro

Dioptidae

Phryganidia californica *Pack.* California
Lauron ergolis *Walk.* Java
L. (Dioptis) vinosa *Dru.* Brazil
Dioptis divisa *Hübn.* Brazil

Thaumetopoedae

Thaumetopoeda (Cnethocampa) processionea *Linn.* Europe
T. (Cnethocampa) pityocampa *Schiff.* Dalmatia

Notodontidae

Apatelodes torrefacta *Sm. & Abb.* Glenville, N. Y.
A. angelica *Grt.* Kittery Point, Me.
Melalopha (Ichthyura) inclusa *Hübn.* Centre, N. Y.
M. (Ichthyura) strigosa *Grt.* Kittery Point, Me.
M. (Pygaera) albosigma *Fitch.* Centre, N. Y.
Pygaera anastomosis *Linn.* Europe
P. curtula *Linn.* Europe
P. anachoreta *Fabr.* Thuringia
P. pigra *Hufn.* Europe
Phalera bucephala *Linn.* Europe
P. bucephaloides *Och.* Europe
Datana ministra *Dru.* Long Island
D. angusi *Grt. & Rob.* Kittery Point, Me.
D. major *Grt. & Rob.* Long Island
D. floridana *Graef.* Florida
D. perspicua *Grt. & Rob.* Long Island
D. integerrima *Grt. & Rob.*
D. contracta *Walk.* Tiffin, O.
Ptilophora plumigera *Esp.* Hungary
Pterostoma palpina *Linn.* Thuringia
Lophopteryx camelina *Linn.* Europe
L. cuculla *Esp.* Europe
Ochrostigma (Drynobia) velitaris *Hufn.* Europe
O. (Drynobia) melagona *Bkh.* Europe
Odontosia (Lophopteryx) carmelita *Esp.* Europe
Leucodonta (Notodonta) bicoloria *Schiff.* Russia
Spatalia (Notodonta) argentina *Schiff.* Europe
Hyperaeschra (Notodonta) stragula *Grt.* Glenville, N. Y.
Notodonta basitriens *Walk.* Sharon, N. Y.
N. simplaria *Graef.* New York
N. ziczac *Linn.* France
N. dromedarius *Linn.* Europe
N. phoebe *Siebert.* (torva *Hübn.*). Europe
N. tritophus *Esp.* Europe
N. trepida *Esp.* Europe
Pheosia dimidiata *Herr.-Schaef.* (rimosa *Pack.*). Colorado
P. (Notodonta) tremula *Clerck.* Europe
P. (Notodonta) dictaeoides *Esp.* Europe

Drymonia (Notodonta) chaonia *Hübn.* Europe
Hoplitis (Hybocampa) milhauseri *Fabr.* Dalmatia
Lophodonta ferruginea *Pack.* Adirondack mts, N. Y.
L. angulosa *Sm. & Abb.* Hamilton, Ont.
Nadata gibbosa *Sm. & Abb.* Hamilton, Ont.
Nerice bidentata *Walk.* Hamilton, Ont.
Symmerista (Edema) albifrons *Sm. & Abb.* Hamilton, Ont.
Exaereta (Uropus) ulmi *Schiff.* Europe
Stauropus fagi *Linn.* Europe
Litodonta hydromeli *Haw.* Texas
Heterocampa obliqua *Pack.* Georgia
H. manteo *Doubl.* (subalbicans *Grt.*). Ocean Beach, N. J.
H. biundata *Walk.* Saranac Lake, N. Y.
H. (Seirodonta) bilineata *Pack.* Kittery Point, Me.
Ianassa lignicolor *Walk.* Lewis county, N. Y.
Schizura ipomoeae *Doubl.* (Coelodasys biguttata *Pack.*). Saranac Lake, N. Y.
S. ipomoeae *var.* cinereofrons *Pack.* Kittery Point, Me.
S. (Oedamasia) concinna *Sm. & Abb.* Lewis county, N. Y.
S. semirufescens *Walk.* (Oedamasia eximia *Grt.*). Kittery Point, Me.
S. (Coelodasys) unicornis *Sm. & Abb.* Centre, N. Y.
S. (Coelodasys) apicalis *Grt. & Rob.* Long Island
S. (Oedamasia) badia *Pack.* Lewis county, N. Y.
S. (Coelodasys) leptinoides *Grt.* Kittery Point, Me.
Dicranura (Harpyia) erminia *Esp.* Europe
D. (Harpyia) vinula *Linn.* Europe
Cerura scitiscripta *Walk.* Kansas
C. scitiscripta *var.* multiscripta *Riley.* Georgiana, Fla.
C. occidentalis *Lint.* Lewis county, N. Y.
C. (Harpyia) bicuspis *Bkh.* Europe
C. (Harpyia) furcula *Clerck.* Europe
C. (Harpyia) bifida *Hübn.* Europe
Harpyia (Cerura) borealis *Boisd.* Lewis county, N. Y.
H. (Cerura) cinerea *Walk.* Hamilton, Ont.
H. (Cerura) scolopendrina *Boisd.* *var.* albicoma. Colorado
Fentonia (Heterocampa) marthesia *Cram.* Lewis county, N. Y.
Gluphisia septentrionalis *Walk.* (trilineata *Pack.*). Albany, N. Y.

Thyatiridae

Habrosyne scripta *Gosse.* Lewis county, N. Y.
H. (Gonophora) derasa *Linn.* Europe
Pseudothyatira cymatophoroides *Guen.* Centre, N. Y.
P. expultrix *Grt.* Centre, N. Y.
Thyatira batis *Linn.* Russia
Euthyatira (Thyatira) pudens *Guen.* Albany, N. Y.
Bombycia (Cleoceris) viminalis *Fabr.* Europe

Liparidae

Hypogymna (Penthophera) morio *Linn.* Hungary
Orgyia gonostigma *Fabr.* Europe
O. ericae *Germ.* Pomerania
Notolophus antiqua *Linn.* (Orgyia nova *Fitch*). Europe. Lewis county, N. Y.
Hemerocampa (Orgyia) leucostigma *Sm. & Abb.* Albany, N. Y.

Hemerocampa (Orgyia) definita *Pack.* Centre, N. Y.

Olene achatina *Sm. & Abb.* (Parorgyia parallela *Grt. & Rob.*). Rockledge, Fla.

O. achatina *var.* tephra *Hübn.* (Parorgyia obliquata *Grt. & Rob.*). Albany, N. Y.

O. (Parorgyia) achatina *var.* cinnamomea *Grt. & Rob.* Kittery Point, Me.

Dasychira selenitica *Esp.* Thuringia

D. fascelina *Linn.* Europe

D. pudibunda *Linn.* Europe

Porthesia similis *Fuessl.* Europe

Stilpnotia (Leucoma) salicis *Linn.* Budapest, Hungary

Porthetria (Ocneria) dispar *Linn.* Europe

Lymantria (Psilura) monacha *Linn.* Europe

Euproctis (Porthesia) chrysorrhoea *Linn.* Europe

Ocneria detrita *Esp.* Europe

O. rubea *Fabr.* Europe

Endromididae

Endromis versicolora *Linn.* Europe

Lemoniidae

Lemonia (Crateronyx) taraxaci *Esp.* Europe

L. (Crateronyx) dumi *Linn.* Europe

Lasiocampidae

Artace punctistriga *Walk.* Savannah, Ga.

Tolype velleda *Stoll.* Hamilton, Ont.

T. laricis *Fitch.* Lewis county, N. Y.

Malacosoma (Clisiocampa) americana *Fabr.* Lewis county, N. Y.

M. (Clisiocampa) californica *Pack.* Nevada

M. (Clisiocampa) disstria *Hübn.* New York

M. (Clisiocampa) castrensis *Linn.* Europe

M. (Clisiocampa) neustria *Linn.* Europe

M. (Bombyx) alpicola *Stegr.* Europe

Trichiura (Bombyx) crataegi *Linn.* Thuringia

Poecilocampa (Bombyx) populi *Linn.* Europe

Eriogaster (Bombyx) rimicola *Hübn.* Europe

E. (Bombyx) catax *Linn.* Europe

E. (Bombyx) lanestris *Linn.* Europe

Lasiocampa (Bombyx) quercus *Linn.* Thuringia

L. (Bombyx) trifolii *Esp.* Europe

Macrothylacia (Bombyx) rubi *Linn.* Thuringia

Cosmotriche (Lasiocampa) potatoria *Linn.* Europe

Chilena (Lasiocampa) sordida *Ersch.* Russia

Epicnaptera (Gastropacha) americana *Harr.* Iowa

E. (Gastropacha) americana *var.* californica *Pack.*

E. (Lasiocampa) tremulifolia *Hübn.* Europe

Gastropacha (Lasiocampa) quercifolia *Linn.* Europe

Odonestis (Lasiocampa) pruni *Linn.* Thuringia

Dendrolimus (Lasiocampa) pini *Linn.* Europe

Pachypasa (Lasiocampa) otus *Dru.* Dalmatia

Bombycidae

Bombyx mori *Linn.* New Hampshire (Domesticated)

Platypterygidae

Orcta (Dryopteris) rosea *Walk.* Adirondack mts, N. Y.
O. (Dryopteris) irrorata *Pack.* Adirondack mts, N. Y.
Cilix glaucata *Scop.* Europe
Drepana (Platypteryx) arcuata *Walk.* Adirondack mts, N. Y.
D. (Platypteryx) arcuata *var.* genicula *Grt.* Catskill, N. Y.
D. falcataria *Linn.* Europe
D. curvatula *Bkh.* Europe
D. harpagula *Esp.* Europe
D. lacertinaria *Linn.* Europe
D. binaria *Hufn.* Europe
D. cultraria *Fabr.* Europe
Mimallo plagrata *Guen.* Brazil

Geometridae

Nyctobia limitata *Walk.* (Lobophora vernata *Pack.*). Centre, N. Y.
N. fusifasciata *Walk.* (Lobophora anguilineata *Grt.*). South Abington, Mass.
Lobophora polycommata *Hübn.* Europe
L. sertata *Hübn.* Europe
L. carpinata *Bkh.* Europe
L. halterata *Hufn.* Europe
L. sexalisata *Hübn.* Europe
Cladora atroliturata *Walk.* (Lobophora geminata *Pack.*). Centre, N. Y.
Bessophora (Ptychoptera) staudingeri *Chr.* Siberia
Opheroptera boreata *Hübn.* New Berlin, N. Y.
Cheimatobia brumata *Linn.* Europe
Paleacrita (Anisopteryx) vernata *Peck.* Kansas
Anisopteryx aceraria *Schiff.* Europe
A. aescularia *Schiff.* Europe
Eudule (Euphanessa) mendica *Walk.* Lewis county, N. Y.
E. (Ameria) unicolor *Rob.* Arizona
Lithostege farinata *Hufn.* Budapest, Hungary
Anaitis praeformata *Hübn.* Europe
A. plagiata *Linn.* Europe
A. paludata *Thunb.* Europe
A. paludata *var.* imbutata *Hübn.* Europe
Chesias spartiata *Fuesel.* Europe
Nannia refusata *Walk.* (Heterophleps harveiata *Pack.*). Tiffin, O.
Heterophleps triguttaria *Herr.-Schaef.* Centre, N. Y.
Asthena (Cidaria) candidata *Schiff.* Europe
Tephroclystis (Eupithecia) miserulata *Grt.* Lewis county, N. Y.
T. absinthiata *Clerck.* (Eupithacia geminata *Pack.*). Albany, N. Y.; Europe
T. (Eupithecia) oblongata *Thunb.* Europe
T. (Eupithecia) linariata *Fabr.* Europe
T. (Eupithecia) pusillata *Fabr.* Europe
T. (Eupithecia) abietaria *Gcze.* Europe
T. (Cidaria) pimpinellata *Hübn.* Europe
T. (Eupithecia) castigata *Hübn.* Europe
T. (Eupithecia) satyrata *Hübn.* Europe
T. (Eupithecia) succenturiata *Linn.* Europe
T. (Eupithecia) succenturiata *var.* subfulvata *Hew.* Europe.
T. (Eupithecia) denticulata *Treit.* Europe
T. (Eupithecia) graphata *Treit.* Europe
T. (Eupithecia) nanata *Hübn.* Europe
T. (Eupithecia) innotata *Hufn.* Europe

Tephroclystis (Eupithecia) lanceata *Hübn.* Europe

T. (Eupithecia) sobrinata *Hübn.* Europe

Chloroclystis (Eupithecia) rectangulata *Linn.* Europe

Eucymatoge (Phibalapteryx) intestinata *Guen.* Albany, N. Y.

Venusia cambrica *Curt.* (Epirrita cambricaria *Pack.*). Adirondack mts, N. Y.

V. (Epirrita) duodecemlineata *Pack.* Lewis county, N. Y.

V. comptaria *Walk.* (Epirrita perlineata *Pack.*). Lewis county, N. Y.

Euchoeca (Baptria) albovittata *Guen.* Lewis county, N. Y.

Lythria purpuraria *Linn.* Europe

Minoa murinata *Scop.* Europe

M. murinata *var.* monochroaria *Herr.-Schaef.* Europe

Odezia atrata *Linn.* (chaerophyllata *Linn.*). Europe

Siona decussata *Bkh.* Europe

Hydria undulata *Linn.* Lewis county, N. Y.; Europe

Scotosia vetulata *Schiff.* Europe

Eustroma (Petrophora) diversilineata *Hübn.* Albany, N. Y.

E. (Petrophora) testata *Linn.* Lewis county, N. Y.; Europe

E. populata *Linn.* (Petrophora packardata *Lintn.*). Saranac Lake, N. Y.

E. (Lygris) populata *Linn.* Europe

E. destinata *Mosch.* (Petrophora prunata *var.* lugubrata *Mosch.*). Lewis county, N. Y.

E. (Petrophora) prunata *Linn.* Las Vegas, N. M.; Europe

E. (Petrophora) cunigerata *Walk.* Lewis county, N. Y.

Rheumaptera hastata *Linn.* Adirondack mts, N. Y.

R. (Ochyria) rubrosuffusata *Pack.* California

Zenophleps (Ochyria) lignicolorata *Pack.* Colorado

Percnoptilota (Plemyria) fluviata *Hübn.* Lewis county, N. Y.

Mesoleuca (Rheumaptera) ruficilliata *Guen.* Lewis county, N. Y.

M. gratulata *Walk.* (Rheumaptera brunneiciliata *Pack.*). California

M. (Glaucopteryx) caesiata *Denis & Schiff.* Adirondack mts, N. Y.

M. (Rheumaptera) lacustrata *Guen.* Lewis county, N. Y.

M. (Petrophora) truncata *Hufn.* Adirondack mts, N. Y.

M. (Petrophora) albolineata *Pack.* Orono, Me.

M. (Petrophora) hersiliata *Guen.* Colorado

M. vasaliata *Guen.* (Cidaria rigidata *Walk.*). South Abington, Mass.

Hydriomena autumnalis *Strom.* (trifasciata *Bork.*). Oldtown, Me.

H. taeniata *Steph.* (Rheumaptera basaliata *Walk.*). Adirondack mts, N. Y.

H. californiata *Pack.* Lewis county, N. Y.

H. (Plemyria) multiferata *Walk.*). Albany, N. Y.

H. (Phibalapteryx) latirupta *Walk.* Albany, N. Y.

H. (Rheumaptera) immediata *Grt.* Lewis county, N. Y.

H. (Rheumaptera) unangulata *Haw.* Lewis county, N. Y.

Triphosa dubitata *Linn.* Lewis county, N. Y.

Coenocalpe (Glaucopteryx) magnoliata *Guen.* Lewis county, N. Y.

C. (Rheumaptera) parinotata *Zell.* Rockledge, Fla.

C. (Emplocia) fervifactaria *Grt.* Water Canon, N. M.

C. formosata *Streck.* (Marmopteryx sponsata *Grt.*). Las Vegas, N. M.

Emplocia inconstans *Geyer* (cephisaria *Grt.*). Water Canon, N. M.

Marmopteryx marmorata *Pack.* South Abington, Mass.

Gypsochroa (Ochyria) designata *Hufn.* Lewis county, N. Y.

G. sitellata *Guen.* (Philereme albosignata *Pack.*). Texas

Epirranthis (Ploseria) puverata *Thunb.* Europe
Phibalapteryx (Cidaria) aquata *Hübn.* Europe
P. (Cidaria) tersata *Hübn.* Europe
Petrophora (Ochyria) abrasaria *Herr.-Schaef.* Adirondack mts, N. Y.
P. (Ochyria) ferrugata *Clerck.* Lewis county, N. Y.
P. (Rheumaptera) fluctuata *Linn.* Saranac Lake, N. Y.
Ortholitha coarctata *Fabr.* Europe
O. plumbaria *Fabr.* Russia
O. cervinata *Schiff.* Europe
O. limitata *Scop.* Europe
O. moeniata *Scop.* Europe
O. peribolata *Hübn.* France
O. bipunctaria *Schiff.* Europe
Mesotype virgata *Rott.* Europe
Larentia (Cidaria) dotata *Linn.* Europe
L. (Cidaria) ocellata *Linn.* Europe
L. (Cidaria) bicolorata *Hufn.* Europe
L. (Cidaria) variata *Schiff.* Europe
L. (Cidaria) variata *var.* obeliscata *Hübn.* Europe
L. (Cidaria) juniperata *Linn.* Europe
L. (Cidaria) siterata *Hufn.* Europe
L. (Cidaria) truncata *Hufn.* Europe
L. immanata *Hew.* (Cidaria russata *Stegr.*). Europe
L. (Cidaria) firmata *Hübn.* Europe
L. (Cidaria) aptata *Hübn.* Europe
L. (Cidaria) viridaria *Fabr.* Europe
L. (Cidaria) turbata *Hübn.* Europe
L. (Cidaria) kollariaria *Herr.-Schaef.* Europe
L. (Cidaria) aqueata *Hübn.* Europe
L. (Cidaria) fluctuata *Linn.* Europe
L. (Cidaria) didymata *Linn.* Europe
L. (Cidaria) cambrica *Curt.* Europe
L. (Cidaria) vespertaria *Bkh.* Europe
L. (Cidaria) incursata *Hübn.* Europe
L. (Cidaria) montanata *Schiff.* Europe
L. (Cidaria) suffumata *Hübn.* Europe
L. (Cidaria) quadrifasciaria *Clerck.* Europe
L. (Cidaria) ferrugata *Clerck.* Europe
L. (Cidaria) pomoeriaria *Evers.* Europe
L. (Cidaria) dilutata *Bkh.* Europe
L. (Cidaria) caesiata *Lang.* Europe
L. (Cidaria) frustata *Treit.* Europe
L. (Cidaria) riguata *Hübn.* Europe
L. (Cidaria) cuculata *Hufn.* Europe
L. (Cidaria) galiata *Hübn.* Europe
L. (Cidaria) sociata *Bkh.* Europe
L. (Cidaria) albicillata *Linn.* Europe
L. (Cidaria) lugubrata *Stegr.* Europe
L. (Cidaria) hastata *Linn.* Europe
L. (Cidaria) hastata *var.* subhastata *Nolck.* Europe
L. (Cidaria) tristata *Linn.* Europe
L. (Cidaria) luctuata *Hübn.* Europe
L. (Cidaria) molluginata *Hübn.* Europe
L. (Cidaria) alchemillata *Linn.* Europe
L. (Cidaria) adaequata *Bkh.* Europe
L. (Cidaria) albulata *Schiff.* Europe
L. (Cidaria) obliterata *Hufn.* Europe
L. (Cidaria) luteata *Schiff.* Europe
L. flavofasciata *Thunb.* (Cidaria decolorata *Hübn.*). Europe
L. (Cidaria) bilineata *Linn.* Europe
L. (Cidaria) sordidata *Fabr.* Europe
L. (Cidaria) capitata *Herr.-Schaef.* Europe
L. (Cidaria) corylata *Thunb.* Europe
L. (Cidaria) berberata *Schiff.* Europe
L. (Cidaria) rubidata *Fabr.* Europe
Haematopsis grataria *Fabr.* Centre, N. Y.
Erastria (Calothysanis) amaturaria *Walk.* Kansas
Rhodostrophia (Pellonia) vibicaria *Clerck.* Europe

Rhodostrophia (Pellonia) calabraria *Zell.* France
Timandra amata *Linn.* Europe
Deptalia (Acidalia) insularia *Guen.* Florida
Cosymbia lumenaria *Hübn.* (Ephyra pendulinaria *Guen.*). Centre, N. Y.
Synelys (Acidalia) ennucleata *Guen.* Lewis county, N. Y.
S. (Acidalia) timandrata *Walk.* Rockledge, Fla.
Cinglis similaria *Walk.* (Acidalia quadrilineata *Pack.*). Lewis county, N. Y.
Leptomeris lautaria *Hübn.* (Acidalia minutularia *Hulst.*). Lewis county, N. Y.
L. (Acidalia) sentinaria *Hübn.* Labrador
L. (Ephyra) plantagenaria *Hulst.* Saranac Lake, N. Y.
Acidalia perpusillaria *Ev.* Russia
A. trilineata *Scop.* Europe
A. flaveolaria *Hübn.* Europe
A. similata *Thunb.* (perochraria *Fabr.*). Europe
A. rufaria *Hübn.* Europe
A. sericeata *Hübn.* Europe
A. moniliata *Fabr.* Europe
A. virgularia *Hübn.* Europe
A. herbariata *Fabr.* Europe
A. bisetata *Hufn.* Europe
A. politata *Hübn.* Russia
A. filicata *Hübn.* Europe
A. robiginata *Stegr.* Europe
A. dilutaria *Hübn.* (holosericata *Dup.*). Europe
A. humiliata *Hufn.* Europe
A. immorata *Linn.* Europe
A. incanata *Linn.* Europe
A. fumata *Steph.* (commutata *Fabr.*). Europe
A. remutaria *Hübn.* Europe
A. emutaria *Hübn.* Russia
A. ornata *Scop.* Europe
A.. violata *Thunb. var.* decorata *Bkh.* France
Ephyra (Zonosoma) pendularia *Clerck.* Europe
E. (Zonosoma) annulata *Schulze.* Europe
E. (Zonosoma) porata *Fabr.* Europe
E. (Zonosoma) punctaria *Linn.* France
E. linearia *Hübn.* (Zonosoma trilinearia *Bkh.*). Europe
Eois demissaria *Hübn.* (Hyria ferrugata *Pack.*). Centre, N. Y.
E. ossularia *Hübn.* (Acidalia ossulata *Pack.*). South Abington, Mass.
E. (Acidalia) inductata *Guen.* Centre, N. Y.
Emmiltis sparsaria *Walk.* (Cymatophora psilogrammaria *Zell.*). Texas
Annemoria faseolaria *Guen.* (Fidonia fasciolaria *Hulst*). California
Chlorochlamys (Eucrostis) chloroleucaria *Guen.* Massachusetts
Hemithea (Nemoria) strigata *Mull.* Europe
Thalera fimbrialis *Scop.* Europe
T. putata *Linn.* (Jodis punctata *Hübn.*). Europe
T. (Jodis) lactearia *Linn.* Europe
Eucrostis incertata *Walk.* (Memoria gratata *Pack.*). Centre, N. Y.
Memoria pulmentaria *Guen.* Europe
Racheospila (Eucrostis) saltusaria *Hulst.* Indian river, Fla.
Euchloris (Phorodesma) smaragdaria *Fabr. var.* prasinaria *Ev.* Sarepta, Russia
Synchlora aerata *Fabr.* (rubivoraria *Pack.*). Lewis county, N. Y.
S. denticulata *Walk.* (excurvaria *Pack.*). Rockledge, Fla.
Aplodes mimosaria *Guen.* Long Island
Pseudoterpna pruinata *Hufn.* Europe
Anaplodes (Geometra) iridaria *Guen.* Georgiana, Fla.
Geometra papilionaria *Linn.* Russia
G. vernaria *Hübn.* Europe
Fernaldella (Fidonia) fimetaria *Grt. & Rob.* Texas
Epelis (Fidonia) truncataria *Walk.* Centre, N. Y.

Epelis truncataria *Walk.* (Ematurga ocellinata *Guen.*). Mt Kisco, N. Y.

Eufidonia notataria *Walk.* Centre, N. Y.

Orthofidonia exornata *Walk.* Centre, N. Y.

O. (Corycia) semiclarata *Walk.* Centre, N. Y.

O. (Corycia) vestaliata *Guen.* Centre, N. Y.

Mellilla inextricata *Walk.* *var.* xanthometata *Walk.* (Lythria snoviaria *Pack.*). Douglas county, Kan.

Psysostegania (Stegania) pustularia *Guen.* Lewis county, N. Y.

Deilinia variolaria *Guen.* Lewis county, N. Y.

D. erythremaria *Guen.* Lewis county, N. Y.

D. liberaria *Walk.* (Aspilates lintneraria *Pack.*). Centre, N. Y.

D. liberaria *Walk.* (Aspilates lintneraria *var.* diffusea *Pack.*). Centre, N. Y.

D. (Cabera) pusaria *Linn.* Europe

Sciagraphia (Semiothisa) granitata *Guen.* Centre, N. Y.; Oldtown, Me.

S. (Semiothisa) punctolineata *Pack.* Texas

S. heliothidata *Guen.* (Semiothisa ocellinata *Guen.*). Mt Kisco, N. Y.

S. californiaria *Pack.* (Semiothisa californiata *Pack.*). Douglas county, Kan.

S. meadiaria *Pack.* (Phasiane meadiata *Pack.*). Saranac Lake, N. Y.

S. continuata *Walk.* (Marmopteryx strigularia *Walk.*). New Berlin, N. Y.

S. continuata (Phasiane orillata *Walk.*). South Abington, Mass.

S. (Phasiane) mellistrigata *Grt.* Centre, N. Y.

S. (Phasiane) mellistrigata *var.* trifasciata *Pack.* Lewis county, N. Y.

Phasiane partitaria *Hübn.* France

P. clathrata *Linn.* Europe

P. glarearia *Brahm.* Europe

Eubolia arenacearia *Hübn.* Europe

E. murinaria *Fabr.* Europe

Philobia (Semiothisa) enotata *Guen.* Lewis county, N. Y.

Macaria (Semiothisa) s signata *Pack.* Texas

M. (Psammatodes) eremiata *Guen.* Centre, N. Y.

M. (Semiothisa) praeatomata *Haw.* Centre, N. Y.

M. (Semiothisa) praeatomata *var.* bisignata *Walk.* Centre, N. Y.

M. (Semiothisa) mendicata *Hulst.* Arizona

M. (Deilinea) septemfluaria *Grt.* Ohio

Semiothisa (Macaria) notata *Linn.* Europe

S. (Macaria) alternaria *Hübn.* Europe

S. (Macaria) signaria *Hübn.* Europe

S. (Macaria) liturata *Clerck.* Europe

Cymatophora (Eufitchia) ribearia *Fitch.* Lewis county, N. Y.

C. sulphurea *Pack.* (Thamnonoma sulphuraria *Pack.*). South Abington, Mass.

C. (Thamnonoma) brunneata *Thunb.* Lewis county, N. Y.; Europe

C. inceptaria *Walk.* (Thamnonoma argillacearia *Pack.*). South Abington, Mass.

C. (Thamnonoma) subcessaria *Walk.* Schenectady, N. Y.

C. pustularia *Hübn.* (Eumacaria brunnearia *Pack.*). Centre, N. Y.

C. or *Fabr.* Europe

C. octogesima *Hübn.* Russia

C. duplaris *Linn.* Europe

Polyploca (Asphalia) diluta *Fabr.* Europe

P. (Asphalia) ruficollis *Fabr.* Dalmatia

P. (Cymatophora) flavicornis *Linn.* Europe

P. (Asphalia) ridens *Fabr.* Europe

Thamnonoma (Halia) loricaria *Ev.* Europe

Thamnonoma (Halia) wauria *Linn.* Europe

Euaspilates spinataria *Pack.* Colorado

Homochlodes fritillaria *Guen.* (Lozogramma discoventa *Walk.*). Lewis county, N. Y.

Apaecasia (Lozogramma) detersata *Guen.* Centre, N. Y.

A. (Lozogramma) defluata *Walk.* Centre, N. Y.

Catopyrrha (Aspilates) coloraria *Fabr.* Centre, N. Y.

C. (Aspilates) coloraria *var.* dissimilaria *Hübn.* Centre, N. Y.

Perconia (Aspilates) strigillaria *Hübn.* Europe

Enemera (Selidosema) juturnaria *Guen.* Washington

Fidonia limbaria *Fabr.* Digne, France

Eurranthis (Athroolopha) pennigeraria *Hübn.* *var.* chrysitaria *Hübn.* Algeria

E. plumistaria *Vill.* Digne, France

Caripeta divisata *Walk.* Lewis county, N. Y.

C. augustiorata *Walk.* Lewis county, N. Y.

C. angustiorata *var.* latiorata *Walk.* Lewis county, N. Y.

Enypia (Cleora) venata *Grt.* Washington

Gnophos glaucinaria *Hübn.* Europe

G. dilucidaria *Hübn.* Europe

G. myrtillata *Thunb.* *var.* obfuscaria *Hübn.* Europe

Psodos alpinata *Scop.* Europe

P. coracina *Esp.* Norway

Pygmaena fusca *Thunb.* Europe

Ematurga atomaria *Linn.* Russia

Bupalus piniarius *Linn.* Europe

Cleogene lutearia *Fabr.* Europe

Scoria lineata *Scop.* (dealbata *Linn.*). Sarepta, Russia

Aspilates mundataria *Cram.* Russia

A. gilvaria *Fabr.* Europe

Nepytia semiclusaria *Walk.* (Cleora pulchraria *Minot*). Albany, N. Y.

Alcis (Semiothisa) metanemaria *Hulst.* Arizona

A. (Hemerophila) latifasciaria *Pack.* Washington

Nychiodes lividaria *Hübn.* Europe

Paraphia subatomaria *Wood.* Lewis county, N. Y.

Lytrosis (Hemerophila) unitaria *Herr.-Schaef.* Locust Grove, N. Y.

Tornos scolopacinarius *Guen.* (rubiginosus *Morr.*). Texas

Selidosema (Boarmia) humarium *Guen.* Lewis county, N. Y.

S. (Boarmia) umbrosarium *Hübn.* Lewis county, N. Y.

S. ericetaria *Vill.* Europe

Boarmia cinctaria *Schiff.* Europe

B. gemmaria *Brahm.* France

B. secundaria *Esp.* Europe

B. repandata *Linn.* Europe

B. roboraria *Schiff.* Europe

B. roboraria *var.* infuscata *Stegr.* Europe

B. consortaria *Fabr.* Europe

B. angularia *Thunb.* Europe

B. lichenaria *Hufn.* Europe

B. selenaria *Hübn.* Europe

B. consonaria *Hübn.* Europe

B. luridata *Bkh.* Europe

B. punctularia *Hübn.* Europe

Cleora (Cidaria) opacaria *Hulst.* Rocky mountains

C. (Tephrosia) cribrataria *Guen.* Centre, N. Y.

C. indicataria *Walk.* (Boarmia polygrammaria *Pack.*). Lewis county, N. Y.

C. (Boarmia) pampinaria *Guen.* Centre, N. Y.

C. (Boarmia) larvaria *Guen.* Lewis county, N. Y.

Melanolophia (Tephrosia) canadaria *Guen.* Lewis county, N. Y.

Aethaloptera intextata *Walk.* (Tephrosia anticaria *Walk.*). Centre, N. Y.

Ectropis (Boarmia) crepuscularia *Denis & Schiff.* Saranac Lake, N. Y.; Europe

Epimecis virginaria *Cram.* (hortaria *Fabr.*). New York city
Amphidasis betularia *Linn.* Europe
Lycia (Biston) ursaria *Walk.* Centre, N. Y.
L. (Eubyja) cognataria *Guen.* Lewis county, N. Y.
Biston hispidaria *Fabr.* Europe
B. zonaria *Schiff.* France
B. graecarius *Stegr.* Europe
B. hirtaria *Clerck.* Europe
B. strataria *Hufn.* Europe
Nacophora (Eubyja) cupidaria *Grt.* Hamilton, Ont.
Phigalia titea *Cram.* (strigataria *Minot*). Centre, N. Y.
Erannis (Hybernia) tiliaria *Harr.* Hamilton, Ont.
Hybernia rupicapraria *Hübn.* Europe
H. bajaria *Schiff.* Europe
H. leucophaearia *Schiff.* Europe
H. aurantiaria *Esp.* Europe
H. marginaria *Bkh.* Europe
Cingilia (Zerene) catenaria *Dru.* Centre, N. Y.
Lychnosea (Endropia) helviolaria *Hulst.* Colorado
L. intermicata *Walk.* (Aspilates pervaria *Pack.*). Tiffin, O.
Anagoga pulveraria *Linn.* Adirondack mts, N. Y.
Sicya macularia *Harr.* Lewis county, N. Y.
Therina (Ellopia) vitraria *Grt.* Las Vegas, N. M.
T. athasiaria *Walk.* (bibularia *Grt. & Rob.*). Rockledge, Fla.
T. fervidaria *Hübn.* Albany, N. Y.
T. (Ellopia) fervidaria *var.* somniaria *Hulst.* Lewis county, N. Y.
Ellopia prosapiaria *Linn.* Europe
E. prosapiaria *var.* prasinaria *Hübn.* Europe
Epione apiciaria *Schiff.* Europe
E. parallelaria *Schiff.* York, England
E. advenaria *Hübn.* York, England
Venilia macularia *Linn.* Europe
Metrocampa praegrandaria *Guen.* (perlaria *Pack.*). Lewis county, N. Y.
M. margaritata *Linn.* Europe
M. honoraria *Schiff.* Europe
Numeria pulveraria *Linn.* Europe
N. capreolaria *Fabr.* Europe
Eugonobapta (Acidalia) nivosaria *Guen.* Centre, N. Y.
Ennomos (Eudalimia) subsignarius *Hübn.* Albany, N. Y.
E. magnarius *Guen.* (Eugonia alniaria *Hübn.*). Albany, N. Y.
E. (Eugonia) autumnaria *Werneb.* Europe
E. (Eugonia) quercinaria *Hufn.* Europe
E. (Eugonia) alniaria *Linn.* Europe
E. (Eugonia) erosaria *Hübn.* Europe
Xanthotype (Angerona) crocataria *Fabr.* Lewis county, N. Y.
Agerona prunaria *Linn.* Europe
Plagodis keutzingi *Grt.* (keutzingaria *Pack.*). Lewis county, N. Y.
P. alcoolaria *Guen.* Albany, N. Y.
P. phlogosaria *Guen.* Lewis county, N. Y.
Eurymene dolabraria *Linn.* Europe
Hyperitis amicaria *Herr.-Schaef.* Albany, N. Y.
Himera pennaria *Linn.* France
Crocallis tusciaria *Bkh.* France
C. elinguaria *Linn.* Europe
Opisthograptis (Rumia) luteolata *Linn.* Europe
Ania limbata *Haw.* (Nematocampa filimentaria *Guen.*). Lewis county, N. Y.
Ourapteryx (Urapteryx) sambucaria *Linn.* Europe
Arichanna (Rhyparia) melanaria *Linn.* Europe
Abraxas grossulariata *Linn.* Europe
A. sylvata *Scop.* Europe
A. adustata *Schiff.* Europe
A. marginata *Linn.* (marginaria *Hübn.*). Europe
Bapta bimaculata *Fabr.* Europe

B. temerata *Hübn.* Europe
Gonodontis (Endropia) hypochraria *Herr.-Schaef.* Albany, N. Y.
G. (Endropia) warneri *Harv.* Centre, N. Y.
Gonodontis (Endropia) duaria *Guen.* Centre, N. Y.
G. (Epirranthis) obfirmaria *Hübn.* Centre, N. Y.
G. (Caberodes) autidiscaria *Walk.* Florida
G. (Odontopera) bidentata *Clerck.* Europe
Euchlaena (Endropia) serrata *Dru.* Lewis county, N. Y.
E. (Endropia) obtusaria *Hübn.* Adirondack mts, N. Y.
E. (Endropia) effectaria *Walk.* Lewis county, N. Y.
E. johnsonaria *Fitch* (Endropia bilinaria *Pack.*). Lewis county, N. Y.
E. astylusaria *Walk.* (Endropia madusaria *Walk.*). Mt Kisco, N. Y.
E. (Endropia) marginata *Minot.* Lewis county, N. Y.
Selenia bilunaria *Esp.* (illunaria *Hübn.*). Europe
S. lunaria *Schiff.* Europe
S. tetralunaria *Hufn.* (illustraria *Hübn.*). Europe
Hygrochroa (Pericallia) syringaria *Linn.* Europe
Therapis evonymaria *Schiff.* Europe
Epiplatymetra (Tetracis) coloradaria *Grt. & Rob.* Colorado
E. (Tetracis) grotearia *Pack.* Lewis county, N. Y.
Metanema inatomaria *Guen.* Locust Grove, N. Y.
M. determinata *Walk.* (carnaria *Pack.*). Lewis county, N. Y.
M. (Tetracis) excelsa *Streck. var.* simpliciaria *Grt.* New Mexico
M. (Endropia) textrinaria *Grt. & Rob.* Hamilton, Ont.
Priocycla (Endropia) armantaria *Herr.-Schaef.* Lewis county, N. Y.
Azelina ancetaria *Hübn.* (hubnerata *Pack.*). Mt Kisco, N. Y.
A. ancetaria *var.* peplaria *Hübn.* (*var.* atrocolorata *Hulst*). Tiffin, O.
Syssaura infensata *Guen. var.* biclaria *Walk.* (Drepanodes puber *Grt. & Rob.*). Rockledge, Fla.
Caberodes confusaria *Hübn.* Centre, N. Y.
C. majoraria *Guen.* Saranac Lake, N. Y.
Oxydia vesulia *Cram.* (vesuliata *Guen.*). Rockledge, Fla.
Tetracis crocallata *Guen.* Centre, N. Y.
Sabulodes (Tetracis) lorata *Grt.* Albany, N. Y.
S. (Eutrapela) transversata *Dru.* Albany, N. Y.
Abbotana clemataria *Sm. & Abb.* (Eutrapela clementata *Hübn.*). Lewis county, N. Y.
Phrygionis argenteostriata *Streck.* (Byssodes obrussata *Grt.*). Rockledge, Fla.
Brephos infans *Moschl.* Centre, N. Y.
B. parthenias *Linn.* Europe
B. nothum *Hübn.* Europe
B. puella *Esp.* Hungary

Epiplemidae

Callizzia amorata *Pack.* Adirondack mts, N. Y.

Cymbidae

Sarrothripus revayana *Scop.* (undulana *Hübn.*). Europe
Earias vernana *Hübn.* Europe
E. clorana *Linn.* Europe
Hylophila prasinana *Linn.* Europe
H. bicolorana *Fuessl.* Europe

Nolidae

Nola togatulalis *Hübn.* Europe
N. cucullatella *Linn.* Europe
N. cicatricalis *Treit.* Europe
N. confusalis *Herr.-Schaef.* Europe
N. albula *Schiff.* Europe
Roeselia (Nola) minuscula *Zell.* Hamilton, Ont.

Psychidae

Eurycyttarus (Psyche) confederata *Grt. & Rob.* Atlantic States
Acanthopsyche (Psyche) zelleri *Mann.* Europe
Pachytelia (Psyche) unicolor *Hufn.* Europe
Amicta (Psyche) ecksteini *Led.* Europe
Oreopsyche atra *Linn.* (Psyche plumifera *Och.*). Europe
Sterrhopterix (Psyche) hirsutella *Hübn.* Europe
Rebelia (Fumea) sapho *Mill.* Europe
Epichnopteryx pulla *Esp.* Europe
Psychidea (Epichnopteryx) bombycella *Schiff.* Europe
P. (Fumea) pectinella *Fabr.* Europe

Cochlidiidae

Sibine (Empretia) stimulea *Clem.* Long Island
Euclea delphinii *Boisd. var.* querceti *Herr.-Schaef.* Atlantic States
E. (Parasa) chloris *Herr.-Schaef.* Long Island
Adoneta spinuloides *Herr.-Schaef.* Saranac Lake, N. Y.
Cochlidion (Heterogenea) limacodes *Hufn.* Europe
Heterogenea asella *Schiff.* Europe
Prolimacodes (Limacodes) scapha *Harr.* Long Island
Lithacodes fasciola *Herr.-Schaef.* Minnesota

Megalopygidae

Lagoa crispata *Pack.* Long Island

Pyromorphidae

Pyromorpha dimidiata *Herr.-Schaef.* Arizona
Triprocris (Lycomorpha) constans *Hy. Edw.* New Mexico
Harrisina americana *Guer.-Mene.* New York

Thyridae

Meskea dyspteraria *Grt.* Florida
Thyris fenestrella *Scop.* Europe

Cossidae

Zeuzera pyrina *Linn.* Europe
Cossus centerensis *Lint.* Centre, N. Y.
Prionoxystus (Cossus) robiniae *Peck.* Savannah, Ga.
Cossus cossus *Linn.* Europe
Hypopta thrips *Hübn.* Russia

Sesiidae

Melittia satyriniformis *Hübn.* (Melitia ceto *Westw.*). New York

Podosesia syringae *Harr.* New York

Aegeria (Trochilium) apiformis *Clerck.* Europe; Long Island

Bembecia marginata *Harr.* New York

Sanninoidea (Sannina) exitiosa *Say.* Ohio

Sciapteron tabaniforme *Rott.* Europe

Sesia rutilans *Hy. Edw.* (aureola *Hy. Edw.*). New York

S. tipuliformis *Clerck.* Ontario, Can.; Germany

S. (Aegeria) pictipes *Grt. & Rob.* New York

S. (Aegeria) acerni *Clem.* Ontario

S. scoliaeformis *Bkh.* Europe

S. spheciformis *Gern.* Europe

S. cephiformis *Och.* Europe

S. conopiformis *Esp.* Europe

S. vespiformis *Linn.* (asiliformis *Rott.*). Europe

S. myopaeformis *Bkh.* Europe

S. culiciformis *Linn.* Europe

S. formicaeformis *Esp.* Europe

S. annellata *Zell.* Europe

S. empiformis *Esp.* Europe

S. astatiformis *Herr.-Schaef.* Europe

S. bibioniformis *Esp.* Europe

S. muscaeformis *View.* Europe

S. affinis *Stegr.* Europe

S. chrysidiformis *Esp.* Europe

Pyralidae

Lipocosma sicalis *Walk.* Douglas county, Kan.

Hymenia (Zinckenia) perspectalis *Hübn.* Rockledge, Fla.

Desmia funeralis *Hübn.* (maculalis *West.*). Rockledge, Fla.

Diastictis (Botis) argyralis *Hübn.* Mt Kisco, N. Y.

D. (Botis) argyralis *var.* ventralis *Grt. & Rob.* South Abington, Mass.

D. (Botis) fracturalis *Zell.* Texas

Pilocrocis (Botis) plumbicostalis *Grt.* Rockledge, Fla.

P. inguinalis *Guen.* (Crocidophora anticostalis *Grt.*). Savannah, Ga.

Conchylodes platinalis *Guen.* South Atlantic States, West Indies, South America

Pantographa limata *Grt. & Rob.*

Diaphania (Eudioptis) hyalinata *Linn.* Texas

Evergestis (Mesographe) rimosalis *Guen.* Illinois

E. straminalis *Hübn.* (Mesographe stramentalis *Hübn.*). Albany, N. Y.

Crocidophora serratissimalis *Zell.* (subdentalis *Grt.*). Schenectady, N. Y.

Nomophila noctuella *Denis & Schiff.* Centre, N. Y.

Loxostege (Eurycreon) chortalis *Grt.* Centre, N. Y.

L. obliteralis *Walk.* (Botis marculenta *Grt. & Rob.*). Lewis county, N. Y.

L. (Eurycreon) similalis *Guen. var.* rantalis *Guen.* Douglas county, Kan.

L. (Eurycreon) sticticalis *Linn.* Rocky mountains, California, Europe?

L. commixtalis *Walk.* (Eurycreon ceralis *Zell.*). Block Island, R. I.

Tholeria (Botis) reversalis *Guen.* Bastrop county, Texas

Phlyctaenia ferrugalis *Hübn.* (Botis harveyana *Grt.*). South Abington, Mass.

P. acutella *Walk.* (Botis venalis *Grt.*). Centre, N. Y.

P. (Botis) terrealis *Treit.* Lewis county, N. Y.

Phyctaenia (Botis) extricalis *Guen.* Catskill, N. Y.

P. tertialis *Guen.* (Botis plectilis *Grt. & Rob.*). Lewis county, N. Y.

Cindaphia bicoloralis *Guen.* South Abington, Mass.

Pryrausta pertextalis *Led.* (Botis gentilis *Grt.*). Albany, N. Y.

P. thestealis *Walk.* (Botis magistralis *Grt.*). Centre, N. Y.

P. theseusalis *Walk.* (Botis feudalis *Grt.*). South Abington, Mass.

P. oxydalis *Guen.* (Botis flavidalis *Guen.*). Rockledge, Fla.

P. orphisalis *Walk.* (Botis adipaloides *Grt. & Rob.*). South Abington, Mass.

P. fumalis *Guen.* (Botis badipennis *Grt.*). Lewis county, N. Y.

P. (Botis) illibalis *Hübn.* Tiffin, O.

P. (Botis) penitalis *Grt.* Douglas county, Kan.

P. futilalis *Led.* (Botis erectalis *Grt.*). Lewis county, N. Y.

P. unifascialis *Pack.* (Botis subolivalis *Pack.*). Lewis county, N. Y.

P. (Botis) fodinalis *Led.* California

P. phoenicealis *Hübn.* (Eurycreon onythesalis *Walk.*). Kansas

P. acrionalis *Walk.* (Botis sumptuosalis *Walk.*). Albany, N. Y.

P. (Botis) insequalis *Guen.* South Abington, Mass.

P. (Botis) generosa *Grt. & Rob.* Lewis county, N. Y.

P. (Botis) laticlavia *Grt. & Rob. var.* cinerosa *Grt. & Rob.* Rockledge, Fla.

P. tyralis *Guen.* (Botis diffissa *Grt. & Rob.*). Rockledge, Fla.

P. (Botis) signatalis *Walk.* Hamilton, Ont.

P. (Botis) unimacula *Grt. & Rob.* Mt Kisco, N. Y.

P. funebris *Strom.* (Ennychia octomaculata *Linn.*). Lewis county, N. Y.

P. (Botis) terrealis *Treit.* Europe

Sylepta (Botis) ruralis *Scop.* Russia

Eustixia (Thelcteria) pupula *Hübn.* South Abington, Mass.

Noctuelia thalialis *Walk.* (Emprepes novalis *Grt.*). Texas

Nymphula icciusalis *Walk.* (Hydrocampa gemaulis *Led.*). Locust Grove, N. Y.

N. *sp.* (Hydrocampa) *sp.* Rockledge, Fla.

N. badiusalis *Walk.* (Oligostigma albalis *Rob.*). Albany, N. Y.

Elophila (Cataclysta) avernalis *Grt.* New Mexico

E. (Cataclysta) *sp.* Rockledge, Fla.

Scoparia basalis *Walk.* (libella *Grt.*). Lewis county, N. Y.

S. centuriella *Denis & Schiff.* Lewis county, N. Y.

Aglossa cuprealis *Hübn.* (domalia *Guen.*). Albany, N. Y.

Hypsopygia (Asopia) costalis *Fabr.* Centre, N. Y.

Pyralis (Asopia) farinalis *Linn.* Lewis county, N. Y.

Herculia thymetusalis *Walk.* (Asopia devialis *Grt.*). Adirondack mts, N. Y.

H. intermedialis *Walk.* (Asopia squamealis *Grt.*). Centre, N. Y.

H. (Asopia) olinalis *Guen.* Bastrop county, Texas

Galasa rubidana *Walk.* (Cordylopeza nigrinodis *Zell.*). Schenectady, N. Y.

Schoenóbius melinellus *Clem var.* dispersellus *Rob.* Rockledge, Fla.

S. forficellus *Thunb.* (longirostrellus *Clem.*). Lewis county, N. Y.

Prionapteryx achatina *Zell.* Texas

Crambus girardellus *Clem.* Lewis county, N. Y.

C. leachellus *Zinck.* Lewis county, N. Y.

C. unistriatellus *Pack.* Lewis county, N. Y.

C. praefectellus *Zinck.* Lewis county, N. Y.

C. laqueatellus *Clem.* Hamilton, Ont.

C. agitatellus *Clem.* Lewis county, N. Y.

Crambus hortuellus *Hübn.* (topiarius *Zell.*). Hamilton, Ont.

C. perlellus *Scop.* (sericinellus *Zell.*). Lewis county, N. Y.

C. elegans *Clem.* Catskill, N. Y.

C. myellus *Hübn.* (interruptus *Grt.*). Centre, N. Y.

C. vulgivagellus *Clem.* Albany, N. Y.

C. ruricollelus *Zell.* Hamilton, Ont.

C. mutabilis *Clem.* (fuscicostellus *Zell.*). Lewis county, N. Y.

C. trisectus *Walk.* (exsciccatus *Zell.*). Lewis county, N. Y.

Argyria nivalis *Dru.* Tiffin, O.

A. argentana *Mart.* (Catharylla nummulalis *Hübn.*). Sharon, N. Y.

Chilo densellus *Zell.* Rockledge, Fla.

Benta (Tetralopha) asperatella *Clem.* Hamilton, Ont.

Tetralopha militella *Zell.* Locust Grove, N. Y.

Acrobasis (Phycis) rubrifasciella *Pack.* New Hampshire

Dioryctria (Nephopteryx) aurantiacella *Grt.* New Mexico

Pinipestis zimmermanni *Grt.* Centre, N. Y.

Nephopteryx ovalis *Pack.* New York

Salebria contatella *Grt.* Lewis county, N. Y.

Laodamia (Salebria) fusca *Haw.* Lewis county, N. Y.

Epischnia boisduvaliella *Guen.* (farella *Curt.*). Jamaica

Melitara (Megaphycis) dentata *Grt.* Colorado

Honora mellinella *Grt.* Lewis county, N. Y.

Homoeosoma stypicellum *Grt.* Saranac Lake, N. Y.

Plodia (Ephestia) interpunctella *Hübn.* Hamilton, Ont.

Peoria approximella *Walk.* (Amerastia haematica *Zell.*). Albany, N. Y.

Pterophoridae

Platyptilia marginidactyla *Fitch* (bischoffii *Zell.*). Lewis county, N. Y.

Pterophorus elliottii *Fern.* (Cretidactylus *sp.*). New York

P. cretidactylus *Fitch.* (Cretidactylus *sp.*). New York

Tortricidae

Exartema (Eccopsis) permundanum *Clem.* Lewis county, N. Y.

E. (Eccopsis) exoletum *Zell.* Albany, N. Y.

E. inornatanum *Clem.* Centre, N. Y.

Olethreutes (Penthina) nimbatana *Clem.* Centre, N. Y.

O. (Penthina) hemidesma *Zell.* Centre, N. Y.

O. (Sericoris) coruscana *Clem.* Lewis county, N. Y.

O. (Sericoris) constellatana *Zell.* Albany, N. Y.

O. (Sericoris) instrutana *Clem.* Lewis county, N. Y.

O. (Sericoris) campestrana *Zell.* New Berlin, N. Y.

O. (Sericoris) bipartitana *Clem.* Lewis county, N. Y.

Exentera apriliana *Grt.* Centre, N. Y.

Proteopteryx cressoniana *Clem.* Albany, N. Y.

Ancylis (Phoxopteris) mediofasciana *Clem.* New York

A. (Phoxopteris) nubeculana *Clem.* Orono, Me.

A. (Phoxopteris) spiraeifoliana *Clem.* Centre, N. Y.

A. (Phoxopteris) platanana *Clem.* Lewis county, N. Y.

Ecdytolopha insiticiana *Zell.* Locust Grove, N. Y.

Carpocapsa pomonella *Linn.* Centre, N. Y.

Cydia (Carpocapsa) saltitans *Westw.* Mexico

Acleris (Teras) subnivana *Walk.* Hamilton, Ont.

A. (Teras) nigrolinea *Rob.* Hamilton, Ont.

Epagoge (Dichelia) sulfureana *Clem.* Hamilton, Ont.

Cenopis reticulatana *Clem.* Lewis county, N. Y.

C. pettitana *Rob.* Hamilton, Ont.

Coelostathama (Amphisa) discopunctana *Clem.* Albany, N. Y.

Sparganothis (Oenectra) xanthoides *Walk.* Hamilton, Ont.

S. (Oenectra) violaceana *Rob.* Centre, N. Y.

Archips (Cacoecia) rosaceana *Harr.* Albany, N. Y.

A. (Cacoecia) purpurana *Clem.* Lewis county, N. Y.

A. (Cacoecia) infumatana *Zell.* Lewis county, N. Y.

A. (Cacoecia) rosana *Linn.* Albany, N. Y.

A. (Cacoecia) cerasivorana *Fitch.* Lewis county, N. Y.

A. (Cacoecia) rileyana *Grt.* Douglas county, Kan.

A. (Cacoecia) argyrospila *Walk.* Albany, N. Y.

A. (Cacoecia) fractivittana *Clem.* Hamilton, Ont.

A. (Loxotoenia) clemensiana *Fern.* Albany, N. Y.

A. (Ptycholoma) melaleucana *Walk.* Orono, Me.

Pandemis lamprosana *Rob.* Centre, N. Y.

Tortrix pallorana *Rob.* Hamilton, Ont.

T. quercifoliana *Fitch.* Hamilton, Ont.

T. albicomana *Clem.* Hamilton, Ont.

T. fumiferana *Clem.* Lewis county, N. Y.

Eulia (Lophoderus) quadrifasciana *Fern.* Lewis county, N. Y.

E. (Tortrix) alisellana *Rob.* Hamilton, Ont.

Amorbia humerosana *Clem.* Centre, N. Y.

Phalonia (Conchylis) bunteana *Rob.* Nebraska

Yponomeutidae

Yponomeuta multipunctella *Clem.* Douglas county, Kan.

Atteva aurea *Fitch* (Poeciloptera compta *Clem.*). Georgia

Gelechiidae

Gelechia *sp.* Lewis county, N. Y.

Oecophoridae

Depressaria atrodorsella *Clem.* Hamilton, Ont.

D. pulvipenella *Clem.* Lewis county, N. Y.

D. fernaldella *Wals.* Albany, N. Y.

D. lecontella *Clem.* Locust Grove, N. Y.

D. heracliana *DeG.* Locust Grove, N. Y.

Tineidae

Adela ridingsella *Clem.* (Cryptolechia schlaegeri *Zell.*). Adirondack mts, N. Y.

Acrolophus (Anaphora) plumifrontellus *Clem.* Mt Kisco, N. Y.

A. *sp.* (Acrolopha *sp.*). Rockledge, Fla.

Anaphora popeanella *Clem.* (scardina *Zell.*). Mt Kisco, N. Y.

Hepialidae

Hepialus gracilis *Grt.* (furcatus *Grt.*). Adirondack mts, N. Y.

H. humuli *Linn.* Europe

H. sylvina *Linn.* Europe

H. lupulina *Linn.* Europe

H. hecta *Linn.* Europe

Appendix B

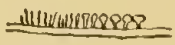
A CATALOGUE OF THE "PHYTOPTID" GALLS OF NORTH AMERICA

BY

GEORGE H. CHADWICK, ZOOLOGIST

Since Dr Hagen published his list in 1885 [The Collection of Phytoptocecidia, or Mite Galls, in the Cambridge Museum. Can. Ent. 17:21], no general check list of our mite galls has been issued. Cook in 1904 [Ind. Dep't Geol. 29th An. Rep't, p. 801] published on the galls of Indiana, and Jarvis has recently [Ent. Soc. Ont. 37th & 38th An. Rep't, p. 56 and 92 respectively] listed the Canadian forms, while Garman in 1892 [American Phytoptocecidii. Psyche, 6:241] described those known to him. Garman's careful paper of 1883 [Ill. State Ent. 12th Rep't, p. 123], moreover, was not seen by Hagen, and all of these papers with other scattering articles contain additions to Hagen's list. Besides these, about 20 unmentioned forms are known to the writer, bringing the total number of American forms up to more than double what Hagen recorded. It has seemed worth while, in view of the interest which must soon center in this rather neglected family of mites, to put this list in print as a guide and check for future work, though in so doing its imperfections and temporary character are painfully evident. Difficulty has been met in correlating various writers, as descriptions from dry or preserved and from fresh specimens often differ greatly. In a few cases recent writers appear to have misapplied the names or descriptions of earlier authors, thus introducing confusion.

The present list is arranged alphabetically by host plants, using Britton and Brown's nomenclature. For convenience certain common types of leaf-galls will be referred to as follows:

Type I......  .....Erineum
" II......  .....Dimple
" III......  .....Capsule
" IV......  .....Pocket } (Cephaloneon of Hagen)
" V......  .....Pouch }

The forms of the first (and second) type, consisting of fuzzy, velvety or frostlike patches of slender, tangled, or capitate hairs (trichomes) were formerly described as fungi and will be found listed in botanical papers such as that of de Schweinitz 1834 in the Transactions of the American Philosophical Society, volume 4, page 289 [*see also* Professor Peck 1869 in 22d Annual Report of the New York State Museum, and Persoon's Mycologia Europaea, 1822. p. 2]. The subgenus Phyllerium was employed by these writers for forms with simple trichomes, while Erineum proper or Grumaria signified those with capitate or mushroom-shaped trichomes, as on right hand side of the figure, type 1. Cecidium is a general term for a gall-deformation whether acarian or otherwise.

Forms occurring in New York State are indicated by an asterisk (*) preceding the number in the following catalogue.

The writer's thanks should be here expressed to those who have given generous assistance and encouragement in the preparation of this paper, as well as of others yet to be published. He is under special obligations to Prof. Nathan Banks of the National Museum, Prof. P. J. Parrott of the Geneva Experiment Station, Dr E. P. Felt, State Entomologist, Prof. C. H. Peck, State Botanist, Mr D. B. Young, Mr J. R. Gillett, and Mr Stewart H. Burnham, besides others who have aided with specimens or information.

Acer glabrum (dwarf maple)

1 A purple erineum in large patches at tips of the lobes and on upper side of the leaf; sometimes sprinkled over under side. Trichomes (hairs) with long stalks.

Garman '92,[1] no. 5 Col.

There are specimens in the State Herbarium, without locality, agreeing with this but bright crimson in color; they are probably from Utah.

Acer negundo (box elder)

2 A white erineum or shallow dimple on under side of leaf, sometimes involving entire leaves of young or basal shoots.

Garman '83, p.136 (Phytoptus sp.) Ill.

3 Irregular wartlike swellings on upper surface of leaf, green to gray, lined below with a green to rusty-brown "granular secretion."

Jarvis '07, p.59, fifth sp. Ont.

This may be identical with the preceding.

[1] See Bibliography at the end.

Acer rubrum (red maple)

*4 A yellowish to deep brown erineum in large patches on under side of leaf. Trichomes capitate.

Garman '92, no. 12 Mass.

Specimens from Sand Lake, in the State Herbarium, labeled Erineum luteolum, and others from the Catskill mountains (Prof. C. H. Peck). N.Y.

Specimens from Lyons pond near Nassau. N.Y.

5 Erineum acerinum Link no. 10, "frequens in A. rubro."

Schweinitz 34, no. 2797 N.C.

This is placed in the section Phyllerium, which has simple trichomes, and so will not agree with either the preceding or following. Persoon, however, describes his E. acerinum (no. 15) under the section Grumaria, having enlarged or deformed trichomes, and as occurring on the under side of the leaves (of four European maples), thus agreeing in character and position with the preceding (no. 4).

*6 A whitish or brown erineum in elongated patches on the veins, on upper side of leaf. Trichomes capitate.

Garman '92, no. 11 N.H.

Specimens from Sand Lake (Professor Peck) in the State Herbarium, labeled Erineum acerinum. N.Y.

This will hardly agree with Persoon's description of E. acerinum; see the preceding, and Persoon '22: no. 15.

*7 A whitish frostlike erineum, with small spots of rosy pink, spreading broadly along the 3 or 5 main veins, on the upper surface of the leaf, sometimes nearly covering it. Trichomes capitate. (This may be merely a variation of the preceding, our specimens of which sometimes showed pinkish brown spots.) Specimens from Altamont in State Herbarium (Professor Peck), labeled Erineum acerinum? N.Y.

A similar gall was observed at an elevation of nearly 2000 feet on Blackhead mountain in the Catskills, last of June, on Acer sp. (?); the specimens unfortunately lost.

Jarvis's figure 1, plate B, looks like a sparsely developed example of this; it is hardly an A. saccharum leaf.

*8 A pocket-gall, similar to that of Eriophyes quadripes and probably the same; see no. 10 for description.

Garman '92, no. 13 Ky., New Eng., Eastern States
Hagen '85, nos. 21, 22, 23(?) D.C., N.H., Mass.

Garman suggests the identity of Hagen's three forms.

Specimens from Normansville and Lyons pond, Nassau, are smaller than those of no. 10 and protrude more below; possibly distinct. N.Y.

Acer saccharinum (dasycarpum) (soft or silver maple)

9 A pale yellow to deep brown erineum on the under side of leaf, avoiding veins. Trichomes capitate, matted.

Garman '92, no. 10 Ill., Mass., Wis.
Hagen '85, no. 26 (Erineum luteolum) N.H.

Garman suspects this may prove identical with his no. 7 (our no. 14).

*10 A nearly spherical pocket-gall (cephaloneon) on the upper side of leaf, varying from light green through red or purple to nearly black. The mite is Eriophyes quadripes (Shimer).

Shimer 1869. Am. Ent. Soc. Trans. II:319 Ill.
Garman '83, p.128, 135, fig. 26, 28 Ill.
Hagen '85, no. 27 Ill.
Lintner '89. N. Y. State Mus. 42d An. Rep't, p.303 N.Y.
Garman '92, no. 9 Middle States, Wis., Ill., Ky.
Cook '04, p.860, first sp. Ind.
Banks '04. Treatise on Acarina, p.106, fig. 192
Felt '07. Park & Woodland Trees, II:630 N.Y.
Jarvis '07, p.59, first sp., pl. F, fig. 1 Ont.
Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 8 (Phyllocoptes quadripes)
Banks '07. Catalogue of Acarina, p.621, Eriophyes quadripes

Specimens from Catskill, and recorded above from Suffolk county and Albany. N.Y.

11 Cook reports Eriophyes acericola on this species; see our no. 17 for description of this pouch-gall.

Cook 1902; Ohio Naturalist, II:278, fig. 11
Cook '04, p.860, second sp. Ind.

Acer saccharum (sugar maple)

Acer saccharinum in Hagen, Garman, etc.

*12 A white or whitish erineum in patches on the under side of the leaf, often limited by the veins. Trichomes capitate. Some-

times associated with no. 16, but then usually sparse. (This may be the fresh stage of our no. 14.)

Jarvis '07, p.62, second sp. Ont.

Specimens from the vicinity of Albany (Mr Gillett) and the Indian Ladder, Helderberg mountains (Mr Burnham). N.Y.

13 Erineum platanoideum Link no. 28, "in foliis."

Schweinitz '34, no. 2805 Pa.

Persoon's description of E. platanoideum, given as a doubtful synonym under his no. 24, E. griseum, agrees well with the preceding, and it seems likely that Schweinitz had that form in hand.

*14 A rusty or brown erineum on the under side of the leaf forming patches along veins. Trichomes capitate, sessile.

Garman '92, no. 7 Ill., Ky.

Except for the described position "along veins" this appears to be the older stage of no. 12, above. Specimens in the State Herbarium agreeing with the latter have taken on the color of this, some nearly black; they are from Fort Edward, [*see* Peck 1869, 22d Rep't, p.101, Erineum luteolum], and Indian Lake (Professor Peck) labeled Erineum luteolum. N.Y.

15 An erineum on the ribs rather elongated.

Hagen '85, no. 24 Western States, Mass.

This should be compared with our no. 6.

*16 A crimson red, purplish or livid erineum in patches on the upper side of the leaf, sometimes sprinkled thinly on the under side also. Trichomes capitate, very short. Apparently whitish when young.

Jarvis '07, p.61, seventh sp., (pl. B, fig. 1 ?) Ont.
Garman '92, no. 8 Mich., N.H.
Hagen '85, no. 25 (Erineum roseum) N.H.

Schweinitz locates E. roseum on Betula nigra, see beyond; this is likely to be his E. purpurascens, however; see no. 20.

Specimens from the vicinity of Albany (Mr Gillett), Indian Ladder, the Helderbergs (Mr Burnham) and remarkably fine ones from Spruce creek at 2250 feet, near Kaaterskill falls. In the State Herbarium from Sand Lake and Garrison (Professor Peck) and Long Island (J. S. Merriam) labeled Erineum acerinum, and from Greenbush (George Clinton?) marked "prob-

ably E. acerinum"; but see under no. 5. Also in the Herbarium from Keene, Essex co. (Professor Peck). N.Y.

The specimens from Garrison, from Long Island and part of those from the Indian Ladder are lighter and more violaceous, the others all a bright crimson. Perhaps there are really two forms; Garman's description fits the violaceous specimens.

*17 A green, reddish or purplish, slender pouch-gall or nail-gall (ceratoneon) projecting from the upper surface of the leaf. The mite is Eriophyes acericola (Garman).

Riley '70. Am. Ent. & Bot. II:339 (Acarus aceris crumena)
Garman '83, p.135 (Phytoptus acericola) Ill.
Garman '92, no. 6 Ill., N.H.
Cook '04, p.860, second sp. Ind.
Parrott '07. N.Y. Agric. Exp. Sta. Bul. 283, no. 7
Jarvis '07, p.59, second sp. Ont.
Banks '07. Catalogue of Acarina, p.620, Eriophyes aceris-crumena (Riley)

Specimens from New Paltz (Miss Foster), Albany (Mr Young) and East Orange (Miss Mitchell). N.Y., N.J.

Acer spicatum (mountain maple)

18 A white, whitish, or pale yellow erineum on the under side of the leaf, in patches often in axils of veins. Trichomes long, tangled and distorted. Quite different from other forms, unless it be the E. acerinum of Schweinitz (see no. 5).

Garman '92, no. 4 N.H.
Jarvis '07, p.62, third sp., pl.B, fig. 2 Ont.

Mr Burnham reports this from the summit of Greylock mt, Mass.

Acer sp.

19 A black velvety erineum in large irregular patches on leaf. (Probably the old stage of some of the preceding).

Hagen '85, no. 29 (Erineum purpurascens) N.H.

20 Erineum purpurascens Link no. 36, "frequens in Acerinis foliis."

Schweinitz '34, no. 2808 Pa.

I suppose this is our no. 16, but the description is not accessible to me. Compare no. 19.

21 An erineum on maple, with capitate trichomes; not further described. The mite is Eriophyes ryderi Banks.

Ryder '79. Am. Nat. XIII:704, fig. (Phytoptus sp.)

Hagen '85, no. 28

Banks '07. Catalogue of Acarina, p.621 (E. ryderi).

As Ryder omits to mention the color or position of the erineum, the kind of maple, or the locality, it would seem that some uncertainty attends the identification of his species. Professor Parrott is at present working on these forms.

Key to the forms of Erineum on Acer

A On upper surface of leaf
- *a* Red or purple, to blackish
  - 1 Mostly at tips of lobes...No. 1 on A. glabrum
  - 2 Scattered between veins...No. 16 on A. saccharum
    ? No. 19 on A. sp.
    ? Erineum purpurascens, no. 20
  - 3 Along veins (see below, no. 7)
- *b* White or yellow, to brown
  - 1 Along veins, elongated...No. 6 on A. rubrum
    No. 15 on A. saccharum
  - 2 Spreading from veins, pink spotted...No. 7 on A. rubrum

B On under surface of leaf
- *a* Dimpled ....Nos. 2 and 3 on A. negundo
- *b* Planate
  - 1 Trichomes simple, long...No. 18 on A. spicatum
    ? Erineum acerinum of Schweinitz on A. rubrum, no. 5
  - 2 Trichomes capitate
    - (*a*) Whitish............No. 12 on A. saccharum
      ? Erineum platanoideum, no. 13
    - (*b*) Yellowish to brown..No. 4 on A. rubrum
      ? Erineum acerinum, no. 5
      No. 9 on A. saccharinum
      No. 14 on A. saccharum
      No. 163 on A. leucoderme
      Erineum luteolum, auct.

Pocket-gall (Eriophyes quadripes)..No. 10 on A. saccharinum
No. 8 on A. rubrum

Pouch-gall (Eriophyes acericola)...No. 17 on A. saccharum
No. 11 on A. saccharinum
No. 164 on A. leucoderme

Alnus alnobetula (mountain alder)

22 Erineum alnigenum Link no. 18 " frequens in foliis Alni undulatae " (=viridis or alnobetula)

Schweinitz '34, no. 2800 Pa.

Placed under section Phyllerium, with simple trichomes.

Alnus glutinosa ? (European alder)

23 Eriophyes brevitarsus Fockeu, making an erineum on species of Alnus, has been recorded from North America by Nalepa, Das Tierreich, Lief. 4, page 8 (1898) ; see Banks '07. As that paper is not accessible to me I am unaware whether it was found on the introduced or a native alder, and am indebted to Professor Banks for the reference.

Connold 1901 [Brit. Veg. Galls, p.130, pl. 49], describes the European gall. on A. glutinosa, as a blisterlike swelling on the upper surface of the leaf often involving the veins and midrib, smooth and glossy above, beneath slightly pubescent. He indicates in the synonymy Erineum alneum Persoon and Phyllerium alnigenum Kunze; these appear from the descriptions to be quite different from each other [see the preceding]. E. alneum Persoon '22: no. 21 is described (from A. glutinosa) as a Grumaria, thus having the trichomes capitate, which distinguishes it from the following forms.

Alnus incana (speckled alder)

*24 A white frostlike erineum on under side of leaf, in the axils of the veins. Trichomes dense, pellucid.

Jarvis '07, p.63, first sp. Ont.

Specimens are in the State Herbarium from Fort Edward [*see* Peck 1869, 22d Rep't, p.101, Erineum alnigerum], Catskill mountains and Albia (Professor Peck) labeled Erineum alnigerum Kunze, "differs from E. alneum Pers." and "near E. tortuosa but hypophyllous and colored." These specimens are orange to rusty brown (dried) and in some the gall covers nearly the entire under surface. N.Y.

Very probably identical with our no. 22, E. alnigenum. For E. alneum see the preceding. The description of E. tortuosum is not accessible to me; very likely it is the following.

25 Small reddish or whitish flat woolen patches (erineum) on the upper side of the leaves.

Hagen '85, no. 30 (Erineum alnigerum) N.H.

Differs from the preceding in position, but may be the same.

Persoon '22, no. 11 describes an E. alni-incani under the section Phyllerium that may be one of these forms.

*26 A small red pubescent pocket-gall on leaf.

Jarvis '07, p.60, third sp. Ont.

Specimens from Shushan (F. Dobbin) and Remsen? (I. L. Nixon), at first green or yellowish; doubtfully from Lyons pond, Nassau, Rensselaer co. N.Y.

This may be compared with the galls of Eriophyes laevis (Nalepa) on Alnus glutinosa; see Connold 1901, British Vegetable Galls, p.140, pl. 54.

Alnus rugosa (serrulata) (smooth alder)

*27 Small remote pocket-galls on the upper side of the leaf. (Perhaps same as preceding).

Hagen '85, no. 31 Western States

A form agreeing fairly with this description, but more crowded and projecting on both sides of leaf, was collected between Albany and Schenectady. N.Y.

Hagen's no. 32, "a hypertrophy of the female aments by a fungus," from the west, included in his list because Baron Osten-Sacken thought it acarideous, is I believe now fully recognized as a fungus-gall. This remarkable deformation has been collected on Alnus incana at Lyons pond, Nassau, Rensselaer county, N.Y. No mites were found in or on the gall.

Amelanchier canadensis (service-berry)

28 A dimple (?) similar to a Phrygian cap, with the tip rolled down, on the upper side of the leaf, rarely below. Older stage (?) larger, yellowish, tip open and woolly.

Hagen '85, no. 33 and ? no. 34 Mass.

Amelanchier rotundifolia [1] (round leaved Juneberry)

29 Small, nearly globular, dark brown pocket-galls, averaging 2 mm in diameter, singly or in clusters on the upper side of the leaf; beneath pubescent and protuberant.

Jarvis '08, p.92, second sp., pl.D, fig. 1 Ont.

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[1] Jarvis erroneously refers this to Amelanchier canadensis in his explanation of the plate.

Ampelopsis (sp?) (ampelopsis)

30 A "nail-gall" (pouch-gall) on the leaves tapering to both extremities and resembling strongly our no. 17.

Garman '83, p.135 (mention) (Southern?)

Garman speaks of this as described by Professor Riley, but I am unable to locate the latter's account. Possibly it is represented by Banks' figure 195, Treatise on Acarina, page 103, in which case the species is Ampelopsis cordata, the simple-leaved Ampelopsis.

Amygdalus persicae (peach)

*31 A silver sheen on the leaf, due to Phyllocoptes cornutus Banks.

Banks 1905. Wash. Ent. Soc. Proc. VII:141 N.J.

Parrott '07. N.Y. Agr. Exp. Sta. Bul. 283, no. 15

Professor Parrott reports this from Shortsville. N.Y.

Anemone virginiana ? (tall anemone)

*32? A golden brown erineum on the under (?) side of the leaf, observed at an elevation of 2700 feet on Blackhead mountain in the Catskills, last of June. As the description and identification are from memory, the specimen being lost, this must be regarded as a doubtful form. N.Y.

Aristolochia macrophylla (sipho) (Dutchman's pipe)

33? A small woolen capsule (?) on the under side of the leaf, with a small rounded woolly opening above. Not certainly Acarian.

Hagen '85, no. 35 Mass.

Aronia nigra (black chokeberry)

(Pyrus melanocarpa)

34 Tiny specklike capsule galls on the leaves, brown when mature, resembling no. 59 on Crataegus.

Jarvis '08, p.94, first sp. Ont.

Apparently the first form reported on this host.

Artemisia sp. (wormwood)

35 A bud deformation of black globes of densely crowded filaments.

Hagen '85, no. 36 New Eng.

Betula lenta (carpinifolia) (sweet birch)

*36 A crimson red erineum, turning to ochreous, in straight beady lines, midway between the ribs or closely bordering the ribs, or both, on upper side of leaf. Trichomes capitate.

Schweinitz '34, no. 2809 (Erineum lineola) Pa.

Specimens in the State Herbarium from the Helderbergs (Professor Peck) labeled E. lineolum. There seems to be no doubt of the identification; de Schweinitz's description is full and precise. Also from Gravel pond, Grafton, Rensselaer co. N.Y.

37 A rosy pink erineum in large patches on the upper side of the leaf.

Garman '92, no. 17 N.H.
Jarvis '07, p.63, fifth sp. Ont.

Possibly a spreading form of the preceding.

Betula lutea (yellow birch)

38 A bud deformation, crowded and irregular, often in bunches of large size.

Hagen '85, no. 37 Mass.
Jarvis '07, p.59, seventh sp., pl.A, fig. 6 Ont.

Betula nigra (red birch)

39 Erineum betulinum Link no. 26.

Schweinitz '34, no. 2804 Pa.

Placed under Erineum proper, with capitate trichomes, and similarly under Grumaria by Persoon '22: no. 17, who describes it as "effusum planiusculum primo subgrumosum albidum, purpureum et roseum, dein rubiginosum obscurum. Cresc. in utraque pagina fol. Betulae albae, sed magis in superiore, praesertim si colore est rubro. Huc pertinent ut varietates E. betulinum roseum et purpureum auctorum."

40 Erineum roseum Link no. 25, "frequens."

Schweinitz '34, no. 2803 Pa., Car.

Persoon considered this a color variety of the preceding, as will be seen from the above quotation. Loew, Verh. der k. k. zool.-bot. Ges. in Wien 1885: 455, 461 describes E. roseum Schultz as forming small irregular, mostly elongated, crummy patches of a blood-red color upon the upper surface of the leaves (of B. alba, humilis and pubescens); in the early summer carmine red.

41 A pocket (?) gall, chiefly on the upper side of the leaf, often confluent.

Walsh '64, p.608, and '67, p.256 — Ill.?
(Hagen '85, p.29)

Betula papyrifera (paper birch)

42 A yellowish white to brownish erineum forming large patches between the ribs on the under side of the leaf. Trichomes capitate, rather long.

Garman '92, no. 14 — N.H.
Jarvis '07, p.62, fifth sp. — Ont.

*43 A nodular pocket-gall, occurring upon both faces of the leaf; yellowish or reddish to purplish; those on the under surface finely pubescent. With preceding.

Garman '92, no. 15 — N.H.
Jarvis '07, p.60, fourth sp. — Ont.

Specimens from North mountain, near the Catskill Mountain House. — N.Y.

Betula populifolia (American white birch)

*44 A bright rusty erineum lining dimples on the under side of the leaf; dark brown or brick-red when dry. Trichomes capitate.

Peck '69, p.101 (Erineum aureum Pers.) — N.Y.
German '92, no. 16, fig. 4 — N.H.

Professor Peck's specimens from Fort Edward, as above, are in the State Herbarium, also others from Nassau (Peck) labeled E. betulinum Reb.; see our no. 39. E. aureum was described from Populus nigra and P. fastigiata, (Persoon '22: no. 23), and appears quite another thing.

Betula pumila (low birch)

45 A transparently white, granular erineum on the surface of the leaves.

Jarvis '07, p.63, fourth sp. — Ont.

Betula sp.

46 Erineum semydophilum Link no. 11, "in foliis betulinis Horti."

Schweinitz '34, no. 2798 — Pa.

Placed under section Phyllerium with simple trichomes, which distinguishes it from any of the preceding forms on birch. Apparently not in Persoon.

Castanea sativa (European chestnut)

47 A small capsule gall on the leaf, more or less spherical, but hemispherical when along side of a vein, diameter 2 to 3 mm; at first green, becoming brown.

Jarvis '08, p.93, second sp. Ont.

Said to be common, but apparently never before recorded in America.

Celtis occidentalis (hackberry)

*48 A witch-broom gall on branches and twigs, produced by an Eriophyes associated with the fungus Sphaerotheca.

Cook '04, p.862, fig. 52 Ind.

Kellerman and Swingle '88. Jour. of Mycology, IV:94 Kan.

Reported (photograph) from Brooklyn (J. J. Levison) N.Y.

Cephalanthus occidentalis (buttonbush)

49 Clusters of small protuberances (dimples?) on the upper side of the leaf, 1 to 3 mm high, paler or reddish; beneath with a white pubescence. The mite is Eriophyes cephalanthi Cook.

Jarvis '08, p.92 (Eriophyes cephalanthi) Ont.

This seems quite different from the following. Professor Jarvis (*in litt.*) informs me that he has found this mite, originally described by Cook from Cuba, in nearly every state from Ontario to Louisiana.

50 A pocket-gall like that on Salix nigra, see our no. 134. Usually very abundant on leaves.

Walsh 1864. Ent. Soc. Phila. Proc. III:608 and 1867, idem VI:286 Ill.?

(Hagen '85, p.29)

Citrus aurantium (orange)

51 Brownish rust spots on the rind, and curled leaves lacking gloss, due to Phyllocoptes oleivorus (Ashmead)

Ashmead 1879, Can. Ent. XI:160 (Typhlodromus oiliioorus) Fla.

Garman '83, p.124 (Phytoptus oleivorus)

(Hagen '85, p.22)

Banks '04. Treatise on Acarina, p.105 (Eriophyes oleivorus) Fla., Cal.

Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 18

Banks '07. Catalogue of Acarina, p.621, Phyllocoptes oleivorus

Citrus medica limon (lemon)

52 Whitened or silvery spots on the rind, and curled leaves, caused by same mite as the preceding.

See no. 51 for references.

Clematis sp. (virgin's bower)

53 Small, short whitish tubes, open at end, in crowded patches on leaves, bud stalks and buds.

Hagen '85, no. 40 Wash.

Cornus canadensis (bunchberry)

54 An erineum in small blackish spots on upper side of leaf.

Hagen '85, no. 41 N.H.

Corylus americana (hazelnut)

*55 A bud deformation, checking further development as soon as it has begun to expand. The mite is Eriophyes avellanae (Nalepa) [*see* Connold '01, Brit. Veg. Galls, p.126, pl. 47].

Specimens from Nassau (Dr Felt) and Albany, (Mr Young) N.Y.

I am indebted to Professor Parrott for the identification of this interesting addition to our fauna first brought in by Dr Felt.

Crataegus coccinea (red haw)

56 " Spinulose blackish galls on the upper side of the leaf."

Hagen '85, no. 44 Mass.

Crataegus crus-galli (cockspur thorn)

*57 Leaf curls.

Hagen '85, no. 43 (Acarus crataegi vermiculus) Ill.

(Walsh '67, Ent. Soc. Phila. Proc. VI:227, Crataegi vermiculus)

Doubtfully from Nassau, Rensselaer co. N.Y.

Crataegus punctata (large-fruited hawthorn)

58 Erineum pyracanthae Link no. 34, " in foliis."

Schweinitz '34, no. 2807 Pa.

Described by Persoon '22, no. 18 from Cotoneaster pyracantha and placed by both in the section with capitate trichomes. Color reddish.

59 A capsule-gall, very small, green to brown, and abundant on the leaves.

Jarvis '07, p.61, sixth sp. Ont.

Resembles the galls of Eriophyes crataegi [Connold '01, Brit. Veg. Galls, p.132, pl.50], on Crataegus oxyacantha.

Crataegus tomentosa (pearthorn)

60 Leaf curls, same as our no. 57.

Hagen '85, no. 42 (Acarus crataegi vermiculus) Ill.

(Walsh '67, p.227, Crataegi vermiculus)

Crataegus sp.

61 Long serpentine leaf-folds disposed radially, convex on upper surface, green and red.

Jarvis '07, p.60, second sp., pl. A, fig. 3 Ont.

Perhaps the same as the preceding.

Dasystoma flava (downy false foxglove)

(Gerardia flava)

62 "Deformation of the leaf."

Hagen '85, no. 49 Mass.

Diospyros virginiana (persimmon)

63 An erineum in numerous small patches on the upper side of the leaf.

Hagen '85, no. 45 D.C.

Euphorbia corollata (flowering spurge)

64 A deformation of the leaves and flower buds.

Cook 1904, Ohio Naturalist, IV:115, fig. 70-72. Ind.?

Fagus americana (ferruginea) (American beech)

*65 A golden rusty to dark brown erineum on the under side of the leaf between the veins. Trichomes capitate. Dry specimens are deep chocolate to black.

Peck '69, p.101 (Erineum fagineum) N.Y.

Hagen '85, no. 47 (Erineum ferrugineum) N.H.

Garman '92, no. 20 Ky., Mich., Mass.

?Trotter '03, p.66, no. 13, fig. 9. [*See* our no. 164½]

Specimens in the State Herbarium from Fort Edward (Professor Peck) as above, Catskill mountains (Peck) "club broader and more abrupt," and Felt House, Lewis co. (Peck) labeled E. fagineum.

Collected at Normansville (Mr Gillett), Gravel pond near Grafton, and Catskill. N.Y.

Hagen's "E. ferrugineum" is evidently a slip by confusion with the old specific name of the host.

65½ Erineum fagineum Link no. 32.

Schweinitz '34, no. 2806 N.C., Pa.

Placed by de Schweinitz (and by Persoon '22: no. 16) in the section with capitate trichomes. Described by Persoon from Fagus sylvatica; his description seems more applicable to the following than the preceding as he says: "in foliis . . . magis versus marginem superiorem. Ab initio album." Loew, however, (Vienna 1885) describes it as "ausnahmslos auf der unteren seite der Blätter," (of F. sylvatica). I do not know which form de Schweinitz had before him; he does not name the host, but the latter is assumedly our native species.

*66 A whitish or golden yellow to brown erineum on the upper side of the leaf between or following the veins. Trichomes capitate. Perhaps a form of no. 65.

Garman '92, no. 19, fig. 5 N.H., Mich.

Specimens from Blackhead mountain at 1850 feet in the Catskills, from Catskill, and near Grafton. N.Y.

This may be compared with the Erineum nervisequum of Persoon '22, no. 22, Loew '85, p.456, occurring on the European species of beech.

Fagus sylvatica (European beech)

67 A frosty, white erineum in large patches on the under side of the leaf. Trichomes spherically capitate.

Jarvis '07, p.62, fourth sp., pl.B, fig. 4 Ont.

This agrees closely with Loew's description of Erineum fagineum [Verhandlung der k.k. zool.-bot. Gesellschaft in Wien, 1885, p.456]; see under no. 65½. Probably identical with our no. 65, and possibly Jarvis cited the exotic beech by an oversight, as he says it is "very common."

Fraxinus americana (white ash)

68 Elongated capsules or vein-galls on the leaves, pinkish above, whitish below, on one side of the vein. Opening underneath, pubescent within. Mites very abundant.

Jarvis '07, p.61, first sp., pl. A, fig. 1 Ont.

*69 Typical capsule-galls, small, irregularly circular and light green in color, on the leaf, the aperture below.

Garman '83, p.137 (Phytoptus sp.) Ill.
Cook '04, p.862 (mention) Ind.
Jarvis '07, p.62 (Eriophyes fraxini) Ont.

Jarvis refers this to Garman's Phytoptus fraxini, but Garman describes the mite as very different and distinctly separates the two. Jarvis says: "upon white ash glabrous," Garman: "a slight clothing of white hairs." See no. 71.

Specimens from New York city (Mr L. H. Joutel) and Poughkeepsie (Mr Nixon). N.Y.

*70 A deformation of the terminal buds, their development arrested, producing a mass of small twisted leaf ends.

Garman '83, p.137 (mention) Ill.
Felt 1907, Park & Woodland Trees II:633 (Eriophyes fraxiniflora) N.Y.

Specimens from Albany; recorded also from Brooklyn. N.Y.

This resembles a fungoid growth, like that on Alnus rugosa, but Dr Felt assures me that he has seen the mite. He considers that it is the staminate flowers which are affected, hence his name for the species.

Fraxinus lanceolata (viridis) (green ash)

71 A small, light green capsule-gall on the leaf, sometimes irregular or confluent. Opening beneath, pubescent. The mite is Eriophyes fraxini (Garman).

Garman '83, p.136, fig. 27 (Phytoptus fraxini) Ill.
Cook '04, p.862 Ind.
Parrott '07, N.Y. Agric. Exp. Sta. Bul. 283, no. 16

Fraxinus pennsylvanica (pubescens) (red ash)

72 Capsule-galls similar to no. 69; hairy.

Jarvis '07, p.62 (Eriophyes fraxini) Ont.

This, also, is probably wrongly referred by Jarvis; see remarks under our no. 69.

Fraxinus sp.

73 Densely crowded pocket-galls covering upper surface of the leaf.

Hagen '85, no. 48 Mass.

Hicoria alba (whiteheart hickory)

(Carya tomentosa)

74 "Deformation and folds on the leaf."

Hagen' 85, no. 39 U.S.

(Walsh '67, Ent. Soc. Phila. Proc. VI:286?)

I do not know whether this is intended to be the same as Hagen's no. 38; the latter is a Phylloxera (Aphid) gall, not a mite.

Juglans cinerea (butternut)

75 A brown velvety erineum surrounding the leaf stalks, or on the main veins, causing a swelling and bending of the stalk or vein.

Schweinitz '34, no. 2810, Erineum anomalum Pa.

Hagen, '85, no. 50 (Erineum anomalum and Juglandis caulis) U.S.

This remarkable form is described at length by de Schweinitz from both J. cinerea and J. nigra. See no. 77.

76 A button shaped pocket-gall on the upper side (usually) of the leaf, green or lighter colored, beneath widely open and lined with whitish or brownish simple trichomes.

Garman '92, no. 18 Ky.

Juglans nigra (black walnut)

*77 The same as no. 75

Schweinitz. '34, no. 2810, Erineum anomalum Pa.

Walsh '67, Ent. Soc. Phila. Proc. VI:227 (Juglandis caulis) Ill.?

Cook '03, Ohio Naturalist III:424, fig. 47, 48 (E. anomalum)

Cook '04, p.859, fig. 50 (Acarus caulis) Ind.

Banks '07, p.620 (Eriophyes caulis)

Jarvis '08, p.93, fifth sp., pl. D, fig. 2 Ont.

As the mite has never been described, the names applied to it have no standing. It is long and cylindrical.

Specimens from Irving, Chautauqua co. N.Y.

78 An erineum and blister on the leaf, referred to the work of Eriophyes tristriatus (Nalepa).

Banks '04, 106 (and *in litt.*) Cal.

This is the Erineum juglandinum of Persoon '22, no. 2, described from Juglans regia; trichomes simple [*see also* Connold '01, Brit. Veg. Galls, p.172, pl. 70, p.182, pl 75].

79 A green warty pocket-gall on either side of leaf, but chiefly the upper, 2 to 5 mm high. Resembles our no. 146

Jarvis '08, p.93, fourth sp. Ont.

Apparently the same as our no. 76 on J. cinerea.

"Leguminous plant, sp.?"

80 "Very small black spots" sprinkling the upper surface of the leaf.

Hagen '85, no. 51 Santa Cruz, Cal.

This sounds more like a fungus than a mite gall.

Nyssa sylvatica (multiflora) (tupelo)

81 A small, round capsule-gall on the leaf, often lobed above, conical below with an opening at the apex. No trichomes. The mite is Eriophyes nyssae Trotter (1903).

Garman '92, no. 1, fig. 1 Va., Ill., Ky.

Trotter '03, p.67, no. 16, fig. 10 (Eriophyes nyssae) N.C.

Banks '07 Catalogue of Acarina, p.621 (and *in litt.*) N.C.

*82 A narrow infolding of the leaf margin upon the upper surface, dark brown when dry, elegantly scalloped [*see* pl. —].

Garman '92, no. 2, fig. 2 Va., Ill., Ky.

Fresh specimens from Lyons pond near Nassau, Rensselaer co., are green to pinkish; the mites are very abundant and light brownish. N.Y.

Populus grandidentata (large toothed aspen)

83 A white to dark brown erineum or dimple-gall on the under side of the leaf. Trichomes granular.

Jarvis '07, p.63, third sp. Ont.

*84 A small green or red pocket-gall (?) on the upper side of the leaf, open below and lined with granules.

Jarvis '07, p.60, eighth sp. Ont.

Specimens from West Athens referred to this, appear as button-like knobs slightly constricted at base and widely open below. Trichomes coarsely granular and distorted. The whole green when fresh, turning brown. Also from North mountain, near the Catskill Mountain House. N.Y.

Populus heterophylla (downy poplar)

85 (?) A rib-gall on the main vein, believed to be Phytoptid. Specimen from Newfoundland village (L. H. Joutel). N.J.

Populus nigra, var. **italica** (Lombardy poplar)

86 A large deep, sharply defined dimple, green, orange-yellow within, 4 to 12 mm in diameter, 2 to 5 mm deep, convex toward the upper surface of the leaf.

Jarvis '08, p.93, third sp., pl. D, fig. 3 Ont.

Populus tremuloides (American aspen)

*87 An olive-buff to olive-brown erineum or dimple, slightly indented on the under side of the leaf, up to 6.5 mm in diameter, one to eight of these on a leaf. Trichomes coarsely capitate or calyculate.

Specimens from Albany, and in the State Herbarium from Shandaken (Professor Peck) labeled Erineum aureum, and "neither aureum nor populinum according to Greville," and from Center, now Karner, Albany county (Peck) labeled E. aureum, and "not like aureum as figured in Greville." N.Y.

Erineum aureum Persoon '22, no. 23, is described from Populus nigra and P. fastigiata and placed in the section Taphria (Taphrina) having the trichomes fused into a crust: it is evidently different from this.

Erineum populinum Persoon '22, no. 20, placed under Grumaria with trichomes capitate, is described from P. tremula as "cespitulis orbicularibus immersis grumosis opacis spadiceis," which agrees passably with the present form.

88 Dimples "on the leaves on the upper side lined with spherical granules, reddish or greenish in color." The galls are green, three to four to a leaf, 2 to 3 mm in diameter.

Jarvis '07, p.60, sixth sp. Ont.

May be the same as the preceding, but the description is ambiguous and gives the impression that this gall is the reverse of that.

*89 Both edges of the leaf inrolled toward each other on the upper surface. The mites not observed, but believed to be Phytoptid. Compare the work of Eriophyes tetratrichus (Nalepa) on Tilia europaea [Connold '01, Brit. Veg. Galls, p.166, pl. 67].

Specimens from Albany (Mr Young). N.Y.

*90 A deformation of stem and twigs producing large irregular galls, the "Knospenwucherungen" of the Germans. The mite is Eriophyes populi (Nalepa).

Nalepa, Vienna 1890, 43, pl. 3, fig. 6

Banks '07, p.621 and *in litt.* N.Y., Col., Idaho

Jarvis '08, p.93, sixth sp. Ont.

Occurs in Europe on Populus tremula; this is Calycophthora populi Amerling and Batoneus populi Kirchner. Professor Banks (*in litt.*) gives me the New York record, "Lebanon Springs, July 11, 1895, W. H. Harrison."

Potentilla canadensis (five-finger)

91 A whitish erineum resembling minute tufts of grass, numerous on both sides of the leaf. Trichomes simple.

Garman '92, no. 3, fig. 3 Va.

Potentilla pennsylvanica (prairie cinquefoil)

92 "Erineum on the leaves; somewhat doubtful."

Hagen '85, no. 53 Saskatch.

Compare with the preceding.

Prunus americana (wild plum)

*93 A very long, slender pouch-gall, green or whitish, on the under side of the leaf. The mite is probably Eriophyes pruni Schoene mss, (Parrott '07, N.Y. Agric. Exp. Sta. Bul. 283, no. 13), which Professor Banks (*in litt.*) would refer to E. pruni-crumena [Walsh 1868, Ill. 1st Rep't, p.55] Banks, Catalogue of Acarina, p.621.

Specimens from Normansville, Albany co. N.Y.

? Jarvis '07, p.61, third sp. Ont.

Jarvis's description implies that his gall was on the upper side of the leaf; otherwise it agrees with this.

Prunus angustifolia (Chickasaw plum)

94 A pocket-gall on the leaves, elongated and purselike on the lower side, tomentose; above rounded and hairy.

Lintner '96 N.Y. State Mus. 50th An. Rep't, p.318, 350 Pa.

Dr Lintner suggests that the mite is "Phytoptus pruni Amerl."

Prunus domestica (plum)

*95 A tubercular growth encircling base of buds and shoots, caused by Eriophyes phloeocoptes (Nalepa).

Jarvis '07, p.59 Ont.
Banks '04, p.105
Parrott '07, no. 14 U.S.

A widely distributed pest. The N. Y. citations will be given in the forthcoming check list of Acarida.

Prunus maritima (beach plum)

96 "Deformation of the leaves."

Hagen '85, no. 54 Mass.

97 Long pedunculated black pouch-galls on the upper side of the leaves.

Hagen '85, no. 55 Mass.

98 A smaller and shorter stalked, green pouch-gall on (the upper side of) the leaves. Same as our no. 100.

Hagen '85, no. 56 Mass.

Prunus pennsylvanica (pin cherry)

99 Reddish, slender pouch-galls, somewhat irregular and pubescent.

Jarvis '08, p.94, third sp. Ont.

Except for the pubescence, this is of the type of the following.

Prunus serotina (wild black cherry)

*100 A green or rosy red pouch-gall on the upper side of the leaf, rupturing when old. The mite is believed by Professor Parrott to be Eriophyes padi (Nalepa) *var.*

Walsh '67 Ent. Soc. Phila. Proc. VI:226 (Cerasi crumena) Ill.

Hagen '85, no. 58 West Point, N.Y.
Beutenmüller '92. Am. Mus. Bul. IV:278, pl. 16, fig. 7 (Acarus serotinae) N.Y. city
Beutenmüller '04. Amer. Mus. Jour. IV, no. 87, fig. N.Y.
Cook '04, p.858, fig. 49 (Acarus serotinae) Ind.
Jarvis '07, p.61 (Eriophyes serotinae) Ont.
Banks '07, Catalogue of Acarina, p.621, Eriophyes serotinae

Specimens from Poughkeepsie (Mr Nixon) and Catskill; observed on Blackhead mountain, Catskills, at 3360 feet. N.Y.

Specimens from Pownal (Mr Burnham). Vt.

101 A pocket-gall (?) shorter and more densely crowded than the preceding. (Compare our no. 104).

Hagen '85, no. 59 Col.

102 Leaf deformation, same as our no. 96.

Hagen '85, no. 57, no. 61 Md., Mass.

Prunus virginiana (chokecherry)

*103 Erineum (?) pruni Schweinitz (no. 7), "nervos sequens. An hujus generis? Floccis longis subrectis utrinque circum nervum folii centralem densissime sitis, in pagina aversa colore badio-ferrugineo, ad 2–3 linearem longitudinem extensis nec intricatis aut saltem parum. Denum etiam circum nervos secundarios apparet."

Schweinitz '34, no. 2802 N.Y.

Placed under Phyllerium, with simple trichomes. De Schweinitz's specimens were "sent by Halsey," exact locality not stated.

No one else seems to have recognized this form; is it possible that the describer was deceived by the normal pubescence seen on several species of Prunus?

*104 A green or reddish pouch-gall on the upper side of the leaf, differing from no. 100 in lacking the funnel form shape to the aperture. Often much crowded.

Jarvis '07, p. 61, second sp., pl. A, fig. 2 Ont.

Specimens from Catskill. N.Y.

Prunus sp.

105 "A very large erineum," on Prunus? sp.

Hagen '85, no. 60 Mass.

106 Small yellow pocket-galls, crowded on the upper side of the leaves and around some stalks.

Hagen '85, no. 62 Wash.

This may be compared with the galls of Eriophyes similis on Prunus spinosa, in Europe [*see* Connold '01. Brit. Veg. Galls, p.162, pl.65]. Compare also with our no. 101.

Pyrus communis (pear)

*107 The well known "leaf-blister," reddish, green to black, on the upper side of the leaf, caused by Eriophyes pyri (Pag.) The same gall also harbors Epitrimerus pyri and Phyllocoptes schlectendali of Nalepa.

Garman '83, p.125, 140, fig. 24, 25 Ill., U.S.
(Hagen '85, p.22)
(Connold '01. Brit. Veg. Galls, p.150, pl.59)
Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 10 and p.291; many figures
Ia., Mich., Can., Del., Pa., N.Y., O., N.J., Id., Cal., Or.
Jarvis '07, p.60 Ont.

Occurs "throughout most of the pear-growing region" according to Professor Banks. New York citations will be given in the forthcoming check list of Acarida.

Pyrus (Malus) coronaria (American crab apple)

108 An erineum on the under side of the leaf.

Hagen '85, no. 63 Ill.

Pyrus (Malus) malus (apple)

*109 The "leaf blister," same as our no. 107, and also pimples and pockmarks on the fruit, produced by Eriophyes pyri (Pag.), or E. pyri variolata (Nal.) and harboring E. malifoliae Parrott and Phyllocoptes schlechtendali Nalepa.

Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 10, p.291, 311; many figures N.Y.
Jarvis '07, p.60 Ont.

This gall is probably as widely distributed on the apple as on the pear, but is not recorded. The check list of Acarida will give the New York localities in full.

Quercus alba (white oak)

*110 A yellowish green dimple, convex on the upper surface of the leaf, lined within with a whitish or brownish fuzz. Perhaps the same as our no. 112.

Specimens from Kenwood, Albany co. N.Y.

Quercus coccinea (scarlet oak)

111 A dense mat of brown hairs (erineum) in large patches on the under side of the leaf.

Jarvis '07, p.63, second sp. Ont.

This may be compared with our no. 117.

Quercus macrocarpa (bur oak)

112 A large greenish yellow dimple, slightly convex above, beneath filled with a dense brown pubescence. Sometimes turned inside out forming velvety buttons under the leaf. The mite is Eriophyes querci (Garman).

Garman '83, p.138. (Phytoptus querci) Ind., Ill.

(Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 4)

Jarvis '07, p.61 (Eriophyes querci) Ont.

Jarvis describes the pubescence as white, and the galls as yellowish red when old. Possibly his form is distinct.

Quercus minor (obtusiloba) (post oak)

113 "Deformation of leaves on the margin."

Hagen '85, no. 65 D.C.

Quercus nana (bear oak)

*114 A snuff brown erineum in large patches on the under side of the leaf, filling the space between veins. Trichomes simple, fine, matted, much like the normal tomentum of the leaf except that each tuft of three or four hairs is elevated on a common stalk. Appears similar to the form (no. 117) on Q. velutina, which is a glabrous species.

Specimens in the State Herbarium from Center, now Karner, Albany county (Professor Peck) labeled "E. quercinum Kz. probably." See our no. 118. N.Y.

Specimens from Glen Lake, Warren county (Mr Burnham) N.Y.

Quercus platanoides (bicolor) (swamp white oak)

115 Very small pocket-galls, crowded upon the upper side of the leaf.

Hagen '85, no. 64 Conn.

Quercus rubra (red oak)

*116 A brown erineum on the under side of the leaf. Trichomes fine, simple, matted. The mites are very numerous, white or pinkish.

Specimens from the Indian Ladder, Helderbergs (Mr Burnham). N.Y.

Specimens in the State Herbarium from Sand Lake (Professor Peck), and a single loose leaf without data, marked "E. quercinum probably," have larger patches with some light or whitish portions. See our no. 118, and the following.

Quercus velutina (black oak)

*117 A velvety red erineum on the under side of the leaf, the young parts greenish. Trichomes simple, matted.

Specimens in the State Herbarium from Buffalo (Mr Clinton) labeled Erineum quercinum. N.Y.

Although more brilliantly colored than the preceding it is structurally the same with that, with no. 114, and probably also no. 111. Whether these are the true Erineum quercinum I can not determine; see the following.

Specimens from South mountain, Catskills. N.Y.

Quercus sp.

118 Erineum quercinum Link no. 7, "in foliis."

Schweinitz '34, no. 2796 Pa.

Placed in Phyllerium, having simple trichomes. Persoon '22, no. 5, describes this as "cespitulis immersis laxis rufescente-pallidis nitidis. Fila compressa, intricata, mollia. Hab. in fol. Quercus pubescentis. Phyllerium quercinum Kunze." This agrees passably with the preceding forms referred to it by Professor Peck (nos. 114, 116, 117).

119 Erineum quercus-cinereae Schwein. (no. 6).

Schweinitz '34, no. 2801 N.C.

Placed in Phyllerium, the trichomes therefore simple.

120 "Deformation of leaf on margins."
Hagen '85, no. 66 Mex.
Compare our no. 113.

121 An oval, somewhat woolly, gall on the upper side of the leaf. Not further described.
Hagen '85, no. 67 Col.

Rhus radicans (toxicodendron) (poison ivy)

122 An erineum on the leaves.
Hagen '85, no. 68 Mass.

*123 Irregular rounded dimple-galls, convex on the upper (or under) side of the leaf, green to red or purple in color, usually confluent into granular heaps; inside clothed with white trichomes.
Garman '83, p.134 Ill.
Cook '04, p.862 Ind.
Jarvis '07, p.60, seventh sp., pl. A, fig. 5 Ont.
Observed at Leeds and Catskill N.Y.

Salix alba (white willow)

*124 Small thickenings or inrollings of the leaf margin, green, scattered or coalescent. Apparently the form figured by Connold '01 [Brit. Veg. Galls, p.148, pl. 58]as the work of Eriophyes marginatus, on the same species of willow.
Specimens from Albany (Mr Gillett) N.Y.
Possibly this is the Brittle willow (Salix fragilis) or a hybrid between S. alba and S. nigra, as it differs somewhat from S. alba.

125 *See* no. 127.

Salix amygdaloides (peach-leaved willow)

*126 Very small crimson red pocket-galls or semicapsules on the leaves, much crowded.
Specimens from Irving, Chautauqua co. N. Y.

Salix balsamifera (balsam willow)

127 Small irregular, serrate and roughened pocket-galls or semicapsules, green or red, usually on the upper side of the leaf; beneath sometimes impressed, more often projecting. Occurs on Salix alba, balsamifera, discolor and rostrata.
Jarvis '07, p.60, as "Eriophyes salicola Garman" Ont.

Jarvis's identification with Garman's form is probably erroneous; the galls are very different, see our no. 131. The same error appears to have been made by Cook for no. 136. Probably no. 129 was intended.

Salix bebbiana (rostrata) (Bebb's willow)

128 *See* no. 127.

Salix cordata (heart-leaved willow)

129 A purple or pale green capsule-gall, projecting either above or below the leaf, or both.

Garman '83 p. 137 (Phytoptus sp.) Ill.

This seems to agree well with the foregoing, and may be the cause of the confusion indicated.

Salix discolor (pussy willow)

*130 The same as no. 127.

Jarvis '07, p.60 Ont.

Our specimens, believed to be this form, are strongly pilose above and thickly pubescent beneath, the aperture with swollen protruding margin, agreeing closely with the galls of Eriophyes tetanothrix laevis (Nalepa), on Salix caprea of Europe, figured by Connold '01 [Brit. Veg. Galls, p. 164, pl. 66]. From Gravel pond near Grafton, Rensselaer co., and from Catskill, N. Y.

Salix fluviatilis (longifolia) (long-leaved willow)

*131 A leaf deformation consisting of one or two narrow longitudinal upward folds extending lengthwise of the leaf, opening by a slit below. Color, yellowish green to brown. The mite is Eriophyes salicicola (Garman).

Garman '83, p.138, Phytoptus salicicola Ill.

Parrott '07. N. Y. Agric. Exp. Sta. Bul. 283, no. 2

Specimens from Irving, Chautauqua co. N.Y.

Salix fragilis (?) (brittle willow)

132 Deformation of leaf and twig, usually clustered near the terminus, whitish green at first, turning grayish black by winter.

Jarvis '08, p.93, first sp., pl. D, fig. 5 Ont.

This is unquestionably "Salicis aenigma" (our no. 133) on a new host if Jarvis's identification of the latter in the explantation of plates is correct. But why not S. nigra?

Salix nigra (black willow)

133 A bud deformation of the flower catkins (fide Walsh '64, p.608) and leaf buds or parts of leaves (fide Cook) producing a large irregular crumpled mass, or core covered with filaments.

Walsh '64. Ent. Soc. Phila. Proc. III, no. 15, p. 576, 608, (Salicis aenigma) Ill.
Walsh '67, idem VI, no. 15, p.227
Hagen '85, no. 69 (Salicis aenigma) Ill.
Osborn and Underwood '86. Can. Ent. XVIII: 12 (Acarus? aenigma)
Cook '04, 859 (Acarus aenigma) Ind.
Banks '07. Catalogue of Acarina, p.620 (Eriophyes aenigma)

Evidently a variable form, but Walsh's and Cook's descriptions are much at variance. Of course the name transferred from the gall to the undescribed mite has no standing.

134 A pocket or capsule-gall, irregularly hemispherical, greenish yellow, with a projecting aperture; on either surface of the leaf but chiefly above.

Walsh '64. Ent. Soc. Phila. Proc. III: 576, 606, no. 14 (Salicis semen) Ill.
Walsh '67, idem VI: 226, no. 14
Hagen '85, no. 70 (Salicis semen) Ill.
Osborn and Underwood '86. Can. Ent. XVIII, p.12 (Acarus? semen)
Cook '04, p.858 (Acarus semen) Ind.
Banks '07. Catalogue of Acarina, p.621 (Eriophyes semen)

This seems fully identical with no. 127, etc. The mite is undescribed. Cook appears to have recognized this and the preceding on other species of willow, not specified.

*135 Small and very crowded pocket-galls upon the leaves.

Hagen '85, no. 71 Wash.

Specimens from Nassau, Rensselaer co. N.Y.

Salix sp.

136 "A small, rather irregular more or less spherical gall occurring in great abundance on the upper surface of the leaves."

Cook '04, p.862 (Eriophyes salicicola) Ind.

The identification is of course erroneous, see our nos. 127 and 131. Although Cook separated this from our no. 134, no distinguishing marks are given.

137 A capsule-gall, raised about equally on both sides of the leaf. The mite is Cecidobia salicicola Banks.

Banks '05, p.142 (C. salicicola) Col.

This also appears of similar type to the "Acarus semen" series. Nalepa [Marcellia 5, p. 124] refers this supposed new genus to Phyllocoptes.

Forms of Mite-Galls on Salix

1 Bud deformation........	No. 132 on S. fragilis
	No. 133 on S. nigra (Eriophyes "aenigma")
2 Longitudinal leaf folds...	No. 131 on S. fluviatilis (Eriophyes salicicola)
3 Inrolled leaf margins....	No. 124 on S. alba (Eriophyes marginatus?)
4 Capsule or pocket-galls..	No. 126 on S. amygdaloides
	No. 127 on S. balsamifera
	No. 125 on S. alba
	No. 128 on S. bebbiana
	No. 130 on S. discolor (cf. Eriophyes tetanothrix)
	No. 129 on S. cordata (Phytoptus sp. Garman)
	No. 134 on S. nigra (Eriophyes "semen")
	No. 135 on S. nigra
	No. 136 on S. sp.
	No. 137 on S. sp. (Cecidobia salicicola)

Sambucus canadensis (American elder)

*138 The leaf margin rolled tightly upward and inward on both sides, bearing stout whitish or brownish trichomes within. A few dried mites were seen, not much longer than broad (shrunken?) and with rather coarse striae; probably a Phyllocoptes.

Specimens from Albany (Mr Gillett). N.Y.

Sorbus americana (American mountain ash)

*139 A light brown or whitish erineum on the under side of the leaf, not crossing the midrib. Trichomes simple (?)

Specimens in the State Herbarium from Ausable ponds (Professor Peck) N.Y.

This may be compared with Erineum sorbeum, no. 8 of Persoon '22

Spiraea salicifolia (American meadow-sweet)

140 Arrested development of the flower buds. The mite is an Eriophyes.

Specimens from Kinistino, Saskatchewan, sent by Dr James Fletcher. Can.

Spiraea sp.? (spiraea)

141 " Probably Cephaloncon on the leaves "

Hagen '85, no. 72 Mass.

Statice armeria (?) (sea pink)

(Plumbago sp.: Hagen)

142 An erineum (?) of very small black spots on the upper side of the leaves, similar to our no. 145.

Hagen '85, no. 52 Cal.

This may be a fungus. Statice seems to be the only west coast form to which Hagen's " Plumbago " can refer.

Thuja occidentalis (arbor-vitae)

143 A leaf deformation, covered with the eggs and skins. The mite, Eriophyes thujae (Garman) lives in the buds and under the leaves in winter, and on the leaves in summer, but may not often occasion serious damage or noticeable deformations.

Garman '83, p.138, fig. 30 (Phytoptus thujae) Ill.

Hagen '85, no. 74 Mass.

Parrott '07. N.Y. Agric. Exp. Sta. Bul. 283, no. 1

Tilia americana (basswood)

*144 Lobed or serrated green pouch-galls on the upper or rarely the lower side of the leaf. The mite is Eriophyes abnormis (Garman).

Garman '83, p.134 (Phytoptus abnormis) Ill.

Hagen '85, no. 73 U.S.

Cook '04, p.860, fig. 51 Ind.

Felt '07. Park & Woodland Trees, II:631 N.Y.

Parrott '07. N.Y. Agric. Exp. Sta. Bul. 283, no. 6.

Jarvis '07, p.59, pl.C, fig. 6 Ont.

Specimens from Churchville, Monroe co., Rensselaer, Catskill, Normansville, and from Pownal (Mr Burnham). N.Y., Vt.

Recorded above from Albany, and is abundant in all parts of the State according to Professor Parrott (*in litt.*).

Triadenum virginicum (marsh St John's-wort)
(Elodes virginica)

145 An erineum (?) of very fine and numerous black spots on the upper side of the leaves.

Hagen '85, no. 43 Ill.

Very probably a fungus.

Ulmus americana (American white elm)

*146 Small green to yellowish pocket-galls, more or less spherical, usually on the upper side of the leaves. The mite is Eriophyes ulmi (Garman).

Garman '83, p.137 (Phytoptus ulmi) Ill.
Cook '04, p.861 Ind.
Parrott '07. N.Y. Agric. Exp. Sta. Bul. 283, no. 5
Jarvis '07, p.59, pl. B, fig. 5–6 Ont.

Specimens from Catskill, and occurs at Geneva (Parrott in litt.). The mite is reported from Newport (Felt '02). N.Y.

Ulmus fulva (pubescens) (slippery elm)

147 A large pouch-gall (up to 2 cm) on the leaves. Differs from the preceding in its unusual size and in often commencing as a cone or deep dimple.

Jarvis '07, p.63, sixth sp. Ont.

This may be one of the three undescribed galls on elm enumerated by Walsh [Ent. Soc. Phila. Proc. VI:285].

*147½ Irregularly lobed pubescent pouch-galls, resembling those on Tilia (no. 144), and much smaller than the preceding (3 to 6 mm), have occurred abundantly at Catskill this summer (1908), seriously affecting the leaves, although none were observed in the previous year. The mites are very numerous, cylindric and whitish. N.Y.

148 A small greenish pocket-gall on the upper side of the leaves, quite similar to our no. 146, and probably made by the same mite. Specimens from Pownal (Mr Burnham). Vt.

Ulmus racemosa (rock elm)

149 The same as our no. 146.

Jarvis '07, p.59 (pl.B, fig. 5–6) Ont.

150 An erineum on the under side of the leaf. Color white (?). Trichomes simple, tangled.

Jarvis '07, p.62, first sp., pl.B, fig. 3 Ont.

This probably is another of Walsh's forms, and with E. ulmi completes the tally of three mite-galls on elm.

Vaccinium sp. (blueberry)

151 Small round galls (capsules?) on the leaves.

Hagen '85, no. 75 Wash.

Verbena hastata (blue vervain)

*152 A white and pinkish frostlike erineum and leaf curl involving the whole plant and apparently very destructive. Mites not numerous, but a few were seen.

Specimens from Nassau, Rensselaer co. N.Y.

Mr G. L. Richard, State Taxidermist, informs me that he has seen this often.

Viburnum dentatum (arrowwood)

*153 Large, irregular lobed dimples, convex above, rarely reversed, pubescent without, within with long slender white hairs.

Specimens from Nassau and Lyons pond, Rensselaer co. N.Y.

*154 Identical with the following.

Specimens from Genesee Valley Park, Rochester. N.Y.

Viburnum pubescens (downy-leaved arrowwood)

*155 Purplish discolorations along the veins, showing on both sides of the leaf and making a striking pattern. The mite is a remarkable form, with longitudinal rows of furbelows (scales), apparently referable to Callyntrotus, a genus not previously reported in America. Professor Banks (*in litt.*) agrees with this reference. See preceding.

Specimens from Lyons pond, Rensselaer co. the entire bush affected. N.Y.

Vitis bicolor (?) (winter grape)

*156 An orange-brown to light chocolate (dry) erineum on the lower side of the leaf, not producing any noticeable depression.

Specimens in the State Herbarium from Greenbush and Fort Edward (Professor Peck) [*see* Peck 1869, 22d Rep't, p.101, Erineum vitis, Poestenkill]. N.Y.

The reference to E. vitis seems questionable on account of the absence of a depression or swelling. See our no. 160.

Vitis cordifolia (frost grape)

157 Small semicircular or nearly circular "wart-galls" (capsules?) along the veins, about 2 mm in diameter and but slightly elevated on either surface of the leaf. Above paler than the leaf, below with a white nipple surrounded by a furrow.

Jarvis '08, p.94, second sp. Ont.

158? A gall of "Eriophyes sp." on this species is figured by Jarvis on plate D, figure 4, but not mentioned in the text. It is evidently quite distinct from the above, being from 5 to 10 mm in diameter and with long white pubescence on the lower surface.

159 A green pouch-gall with irregular lobed top (as in that of E. abnormis), mostly upon the under side of the leaf. "Not common."

Jarvis '07, p.62 ("Eriophyes vitis") Ont.

The reference of this to E. vitis seems to be an error, [see the following] and the description is not greatly unlike the galls of the well known Phylloxera vastatrix (an Aphid), though more slender than the latter usually are.

Vitis vinifera (grapevine)

160 An erineum on the under side of the leaf, causing a swelling above. Trichomes simple. The mite is Eriophyes vitis (Landois).

Banks '04. Treatise on Acarina, p.106 Cal.

Parrott '07. N.Y. Agric. Exp. Sta. Bul. 283, no. 9 (Phyllerium vitis)

This is probably the Erineum (Phyllerium) vitis of Schweinitz '34, no. 2799 (Persoon '22: no. 6). N.C., Pa.

Persoon's description indicates that the erineum is pinkish and later brown.

161 A leaf curl, or warty, greenish elevations on the upper surface of the leaf, entirely smooth on the inner (under) side; becoming browned or reddened when old.

Forbes 1885. 14th Ill. Rep't, p.84 Ill.

Referred doubtfully by Forbes to Eriophyes vitis, but the total absence of trichomes seems to distinguish it notably, moreover the mites differ somewhat.

Vitis sp. (?) (wild grape)

162 Forbes reports the preceding also on "wild grapes" in southern Illinois, (Garman).

ADDENDA

Trotter's paper in Marcellia 2:63 ("Descrizione di varie galle dell' America del Nord") having come to hand after the above list was largely in type, his additional forms are here appended, references to the others having been incorporated in the text. [*See* nos. 65 and 81]

Acer leucoderme (white-bark maple)

163 An erineum in scattered patches mostly on the under surface of the leaf and slightly dimpled, with a corresponding faint discoloration above. Trichomes same as those of E. purpurascens (i. e. capitate).

Trotter '03, p.64, no. 2 — Ga.

This seems to be of the same general type as our no. 14.

164 Slender pouch-galls on the upper side of the leaf.

Trotter '03, p.63, no. 1, fig. 1 — Ga.

Probably referable to the work of Eriophyes acericola; see our no. 17.

Fagus americana (ferruginea) (American beech)

164½ A sparse, somewhat dimpled erineum, of a rosy or vinose color, on the under side of the leaf, with a corresponding discoloration above. Trichomes unusually large, strongly capitate.

Trotter '03, p.66, no. 13, fig. 9

Referred doubtfully to our no. 65, but presents some striking differences.

Hicoria pecan (pecan)

Carya olivaeformis

165 A narrow inrolling of the leaf-edges, especially toward the base; within with ridges, and tufts of hair.

Trotter '03, p.65, no 6, fig. 5 — Ky.

Liquidambar styraciflua (sweet-gum)

166 A tawny or brown erineum on the under side of the leaf close to the petiole, in the angles between the veins. Trichomes simple, cylindric, acuminate.

Trotter '03, p.66, no. 14 — N.C.

Quercus palustris (swamp oak)

167 An erineum, mostly on the under side of the leaf, in the angles of the veins and also spreading along them. Color ashen. Trichomes simple, numerous, cylindrical, grouped in tufts.

Trotter '03, p.71, no. 35, fig. 13, 13a — Tenn.

Quercus texana (Texan red oak)

168 Same as the preceding.
Trotter '03, p.71, no. 39 Tenn.

Quercus velutina (black oak)

169 Same as the two preceding.
Trotter '03, p.72, no. 43 N.C.

The description indicates a form somewhat different from any on oak known to us; compare our no. 117 for differences.

Sorbus americana (American mountain ash)

Pirus americana

170 Leaf-blister, ascribed provisionally to Eriophyes pyri. [*See* our no. 107]
Trotter '03, p.67, no. 17 N.C.

E. pyri has been reported on mountain ash (Sorbus aucuparia) in Europe. [*See* Parrott '07]

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Appendix C

REPORT OF THE ENTOMOLOGIC FIELD STATION CONDUCTED AT OLD FORGE, N. Y., IN THE SUMMER OF 1905

BY

JAMES G. NEEDHAM

In accordance with instructions from the State Entomologist I proceeded to Old Forge, N. Y. at the middle of June 1905 to continue the study of aquatic insects and their relation to the food of fishes, that was begun at Saranac Inn in 1900. Through the cooperation and courtesy of the New York State Forest, Fish and Game Commission, laboratory quarters were soon provided in the Old Forge hatchery and a good collecting boat was placed at my disposal. I was again fortunate in having an experienced and capable collaborator in the person of Dr C. Betten who, while giving special attention to collecting and rearing caddis flies, took a large part in all the other work of the season.

To Mr Henry Davidson who was in charge of the hatchery, and to Mrs Davidson, we were indebted for much information and assistance, and for the kindly and helpful interest they took in our work. Mr A. C. Church, whose house adjoins the hatchery, very kindly placed a convenient dark room at our disposal. The friendly interest of the people of Old Forge, the good collecting grounds near at hand, the varied and interesting fauna, and, during a fair proportion of the time, pleasant weather for outdoor work, all joined to make the field season of 1905 (June 15–August 20) very pleasant and fairly productive of good results. Visits to our station, for the purpose of inspecting our work and of collecting in the field with us, were made by Dr Felt, by Assistant State Entomologist Mr D. B. Young and by the late lamented State Zoologist, Dr F. C. Paulmier, whose untimely death has removed from service a most capable student of the fauna of our State.

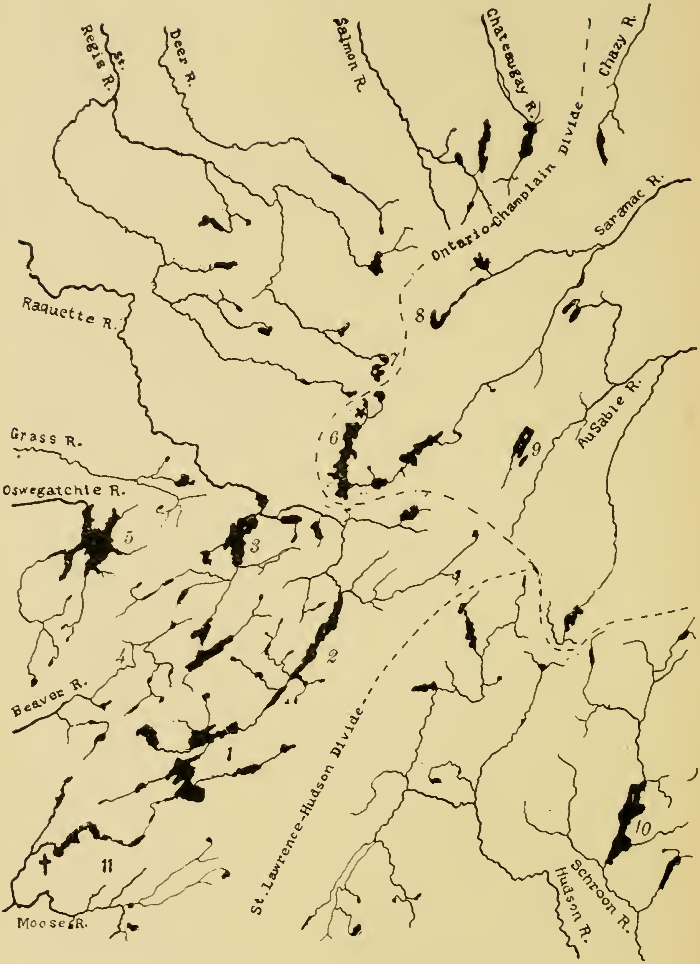
The work done by us was all in continuation of that done before and already reported upon in Bulletins 47, 68 and 86 of this museum. Dr Betten gave his chief attention to collecting and to rearing caddis fly larvae and was very successful in that work. The results

of his study of these insects are reserved for publication in a separate bulletin. I studied mainly stone flies. The results of my work on this group I have reserved for a future bulletin. The largest present gaps in the knowledge of the immature stages of aquatic insects will be filled when these two groups are reported upon; but since these are omitted from present consideration, it is only some supplementary studies the results of which are included in the present brief report; namely, some additions to our knowledge of Ephemeridae and Diptera and some new studies of the food and foraging grounds of fishes.

Localities and methods

Old Forge, as is well known, is situated at the outlet of the Fulton chain of lakes. It has about the same altitude as Saranac Inn (a little more than 1700 feet) and is like the latter place in being surrounded by low densely wooded mountains and hills with lakes and ponds occupying valleys between; but it differs in some minor particulars affecting its fauna. It is on the St Lawrence side of the Adirondack drainage system, while Saranac Inn is on the Champlain side [*see* accompanying map]. It is at the outlet of a chain of lakes where a small river breaks into rapid descent over rocky beds, while Saranac Inn is at the head of a similar chain where streams are slow and sinuous, with sandy beds and sphagnum bordered banks. The differences in fauna are not very marked. Old Forge is richer in the species that live in rapidly flowing water, having an abundance of stone flies and current-inhabiting caddis flies. Saranac Inn is richer in lake and pond species, especially in dragon flies. We collected chiefly from Moose river and Old Forge pond because of their proximity to our laboratory, and from Bald Mountain pond and Beaver Meadow brook because of their very fine faunas. The characteristics of our collecting grounds are worthy of more detailed statement.

Moose river. The hatchery being located directly upon the bank of Moose river [pl. 4] and a stone's throw below Old Forge pond, we naturally visited these bodies of water most frequently. Moose river was disappointing. Often in passing on the old Adirondack railway I had seen its dark waters dashing over the rocks in its channel and had imagined it would be a paradise of stone flies; and such it may have been in times past, but since the construction of the dam and controlling works at the outlet of Old Forge pond,



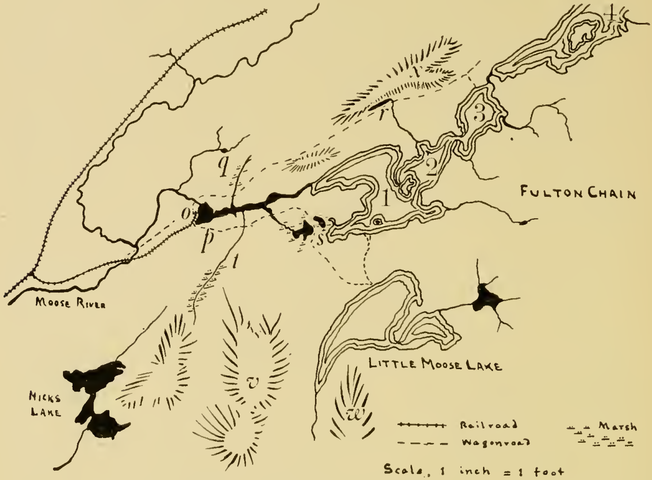
Map 1 Drainage map of the Adirondacks

Lakes: 1 Raquette; 2 Long; 3 Tupper; 4 Ne-ha-sa-ne; 5 Cranberry; 6 Upper Saranac; 7 St Regis; 8 Rainbow; 9 Placid; 10 Schroon; 11 Fulton Chain

its volume is manipulated in the interests of the mills lower down in its course. Water is now high, now low; and when it is suddenly lowered (often reduced to isolated pools with barely a trickling streamlet between them, as I saw it in July and August) the rocks are left high and dry, and such delicate aquatic organisms as stone fly nymphs die of evaporation. I found such animals chiefly in the small side streams. The fauna of the river itself between this dam and the lower tributaries is mainly reduced to such forms as live in the bottom pools. I found the rocks in the channel of the stream itself not less barren of life than was the artificial retaining wall behind the hatchery [shown in pl. 4]. Trap lanterns set out back of the hatchery at this place attracted few insects besides midges and crane flies and these probably came from pools of the stream, or from wet places in the surrounding woods. However, I maintained all summer with somewhat better results, a trap lantern at a place half a mile farther down stream on the west side of the town at a point convenient to the cottage (Camp Sakheywey) in which I spent the summer. Here the lantern attracted numerous May flies (among them the only specimens of Ephemera seen) and big species of caddis flies (Phryganea and Neuronia). Along shore on the deeper side of the river below this place indifferent fishing was indulged in by some of the natives. I saw only chubs, suckers and bullheads taken by them.

Old Forge pond [map 2, *p*]. Neither is this body of water in a state of nature. By the building of the dam its outlines have been altered and its depth has been increased. The water front of Old Forge is here, and the shore along the town is lined with wharves and all the other shores are dotted with cottages. Wintergreen point, which projects boldly from the northward shore, directly in front of the town, has been stripped of its forests to open a vista up the channel toward the chain of lakes in the distance. Nevertheless, the level of the water is fairly constant now, and in the less frequented portions conditions are quite natural and the life of its waters is very little disturbed. The main path toward the lakes of the Fulton chain is so traversed by pleasure craft of all sizes that nowhere else may one get a better view of the procession of pleasure seekers to the great "North Woods" [pl. 5]. Still in the coves which receive the currents of the mountain brooks entering on either side of the channel there is abundance and variety of both plant and animal life. At the hatchery pier near the outlet, there is an extensive

growth of submerged water weed with several pretty patches of pickerel weed standing in adjacent shoals. Here the bottom is deep and muddy and here bullheads, sunfish and horned dace abound and small boys angle for them or catch the smaller of them in wire minnow traps. Schools of the red-bellied minnow may be seen about the edge of the beds of vegetation or darting into the shadow of the few great rocks that lie here.



Map 2 The vicinity of Old Forge

o Old Forge; *p* Old Forge pond; *q* Lily pond; *r* Bald Mountain pond; *s* Twin ponds; *t* Beaver Meadow brook; *v* Little Moose mountain; *w* Panther mountain; 1, 2, 3, 4 the first four lakes of Fulton chain

At the south end of the pond, where a spring is said to enter below the water line, there is much angling for speckled trout, but few trout are taken there, and such as I saw taken were small and lean. Some of the coves that receive spring brooks entering from the south farther up the channel yielded an occasional fine string of speckled trout. One of these coves in which we did considerable collecting, about a mile eastward from Old Forge on the south side of the channel is the one which drains the western of the twin ponds. Growing upon the submerged hemlock tops in this cove were some of the most remarkable growths of fresh water sponges that I ever saw. Great masses [pl. 9, fig. 2] varying between crustaceous and columnar, of a vivid green color, were to be seen

everywhere on the larger branches by one looking down into the water from a boat. This cove also had the usual fringe of fallen tree trunks lying half submerged, decked out to the water line with sundew. In the little side pools were beds of native callas. Still further back was an almost impenetrable tangle of fallen moss-grown boughs intermingled with ferns, and wherever dry enough the ground was overspread with broad shining green mats of bunch-berry. In these thickets mosquitos and caddis flies swarmed.

Spongilla flies, so abundant in the hatchery at Saranac Inn, were rarely seen in the Old Forge hatchery, but their larvae were found in abundance in the osteoles of these living sponge masses, and their cocoons were spun thickly about the timbers of the controlling works at the dam. A trap lantern was maintained all summer at the hatchery pier and captured swarms of little May flies of the genus Caenis, swarms of midges, swarms of caddis flies and occasionally a large number of the pale green crane fly Erioptera chlorophylla.

Since the hatchery received its water supply directly through a short water pipe from the dam, it is rather surprising that so many of the May flies, and the spongilla flies common in the pond did not appear commonly in the building as at Saranac Inn. Only Ephemerella, Hydropyschidae and midges emerged in considerable numbers from the hatchery troughs. Other May flies (Siphlurus and Heptagenia) settled often in large numbers upon the outside of the building.

Two Entomostraca occurred in such numbers within the hatchery that they could not escape observation. One of these was the common holarctic, Sida crystallina, which settled upon the smooth surface of our white earthenware bowls, when these were left standing in the troughs. They adhered to them so securely by a gelatinous secretion as not to be removed by a gentle washing. The other was the remarkable humpbacked Holopedium gibberum, which for a month following the middle of June accumulated in such masses upon the brass screens at the foot of the fish troughs that it could be scraped up from them in handfuls. The hatchery workmen first called my attention to these. Misled by their copious gelatinous envelops and their spherical form, the workmen not unnaturally thought them to be some kind of eggs.

On the bowls with Sida there occurred in small numbers curious little Oligochaete worms with long proboscis that I took to belong to the genus Stylaria.

Bald Mountain pond [map 2, *r*]. This pond was the richest in aquatic life of any single body of water about Old Forge, but it was three miles distant, up hill most of the way, and there was no boat upon it nor shelter near it. Its banks were difficult of access and built on treacherous sphagnum where footings were very insecure. But its attractiveness was so great that we hauled a boat to it and spent several days upon it; and we returned to it a number of times afterward, by boat to First lake and a climb up the hill to the ledge where it nestles against the foot of the mountain from which it takes its name.

It is but a narrow strip of black water less than half a mile long, a mere dilation of the mountain brook that spreads out and fills a gutter in the rocky slope. From the pond, the brook emerges again to descend in a succession of cascades and numerous windings in and out among fern clad boulders, until it enters the second lake of the Fulton chain through a miniature bottom land marsh.

From the side of the pond the long mountain ridge rises steep and forest clad, and at either end there is a miniature sphagnum meadow decked with orchids and cotton grass and bordered by pale green tamaracks, backed by dark hemlocks and balsam firs. Lumbering operations have left the tops of felled hemlocks lying in its borders half submerged. The floating leaves of yellow water lilies thickly cover its surface wherever the water is not too deep for the long stems to reach bottom.

In these lily beds there was a remarkable abundance of the red newt (Diemyctylus viridescens); a dozen of them could be seen at once almost anywhere on looking down among the tangled stems. I captured a number of them and made an examination of their food and found that they had all been feeding exclusively on a small bivalve mollusk that was common upon the pond bottom.

Almost equally noteworthy for abundance (as well as for the size attained) were the big red leeches (Haemopsis grandis) which could be seen undulating through the water anywhere along shore. This pond has been famed for its trout fishing and it is locally reported that the trout feed freely on these leeches. We were desirous, therefore, of verifying this report by a study of the trout food, and the hatchery staff made an effort to take trout for examination and used both line and seines for that purpose, but without success. No trout were obtained, nor did we see any sign that trout were present in the pond. Perhaps it is now fished out.

At the outlet of the pond (the spot shown at the right hand of the picture in pl. 6) was a bit of open water of wonderful beauty and interest whether one looked across its surface or down into its clear depths. A bed of callas fringed it, backed by a zone of sedges and clumps of alders. On the peaty bottom that was thickly sprinkled with brown plant stems, the agile nymphs of the May fly Siphlurus darted hither and thither and caddis fly larvae in abundance dragged and tumbled their big cobhouse cases about. Great loose masses of disintegrating alga-tinged gelatine, left over from the spring hatching of salamander eggs, draped all the branches of one large hemlock top, while a remarkably fine growth of fresh-water sponge of vivid green color covered another. It enveloped all the twigs and ran out in slender fingerlike processes beyond their tips, and these were beautifully displayed in the still water. On the sixth of July a few winter buds were already developed on the basal parts of some of these sponge masses, and by the aid of the spicules developed in their walls I was able to determine that the sponge is Heteromyenia ryderi, a species not uncommon in the east Atlantic States but one that rarely shows such luxuriance of growth.

Fig 2 The fresh-water sponge Heteromyenia ryderi, on hemlock tops

My notes on dragon flies farther on will show that some fine Cordulines were here, and Aeschnas. Dr Betten carried back to the hatchery and reared many caddis fly larvae taken from this pond. He visited the pond and set out trap lanterns on several evenings, but in each case the chilly, damp night air of so common occurrence in the Adirondacks, settled down at nightfall and his catches were exceedingly light. In other particulars than those mentioned the fauna of this pond seemed quite fairly comparable to that of other small bodies of water in this region. There were a few large diving beetles, and a few exceedingly small ones; a few back swimmers, many water boatmen, a few Ranatras, a few whirl-a-gig beetles and very many amphipod crustaceae (Gammarus) of large size.

Beaver Meadow brook [map 2, *t*]. This delightful woodland brook enters Old Forge pond from the southward about half a

mile distant from the hatchery. On it are located the new fish ponds, a few hundred yards up the glen from its mouth. Here the young trout are kept in the feeding troughs during the summer after the water in the hatchery has gotten too warm for them, and here in pens made in the brook itself, a number of adult trout are pastured; they feed in part at least on the natural forage the brook affords. Above the ponds for a little way the course of the brook is steep and tortuous and its channel has been undisturbed. It winds in and out among moss-grown boulders, sweeps over little falls [pl. 7] that are draped with long moss and lies still in little hollows that are but half exposed to the sky above. Here was a most excellent collecting ground for aquatic insects, and here were spent very many pleasant hours of field work. Here we set our tent trap [pl. 8], to be described farther on, and preserved its captures regularly for a month.

The Adirondack League Club road to Little Moose lake crosses the brook about as far above the fish ponds as these are above the shore line, and this crossing is an excellent collecting ground. Butterflies and syrphus flies swarm here, about a few roadside flower clumps. Along the roadway some fine dragon flies were found coursing back and forth: it was here I took the only specimen I have ever seen alive of Gomphus ventricosus, adding another to the list of species belonging to the fauna of the State. Over a pool just above the bridge and under a leafy canopy that is held aloft by two slender birch trunks, little white and brown May flies, and midges, and crane flies congregated and danced in the air up and down of late afternoons, and pale green stone flies were to be seen running over the witch hazel leaves.

Above the road the descent of the brook is more gentle and soon its channel widens out into the "Beaver Meadow." It is a bit of upland marsh apparently formed above Beaver dams in aboriginal times. Its level floor is built on sphagnum. It is dotted with pitcher plants and plumed with cotton grass and ornamented in some of the wetter spots by abundant yellow Habenarius. It is not a wet marsh for the most part and it is being invaded by bordering shrubbery and scattered pale tamaracks, and it is traversed by the sinuous alder-bordered brook, which here glides along over a level bottom that is thickly strewn with brown peaty marsh and silt. Springs from the marsh and from other lesser marshes of similar origin situated farther up on the sides of Little Moose

mountain feed the stream and supply the fish ponds with cool water. The stream is swollen after every freshet and then it gathers much silt, which gives a great deal of trouble by clogging the screens in the fish troughs. Of the insects collected from the stream within the meadow, only May fly nymphs of the genus Leptophlebia and caddis fly larvae of a number of wooden case building species were found in any considerable abundance.

Another locality at which we did some collecting was Lily pond [map 2, *q*], a shallow pond in the woods a mile north of the hatchery, reached by numerous roads and trails, each one worse than the other. We made several trips to it with great discomfort, the way being difficult and the mosquitos hungry and excessively abundant, but we found it an excellent collecting ground, the best for dragon flies of the summer, and two new life histories in that group, to be found in a subsequent section, were added there.

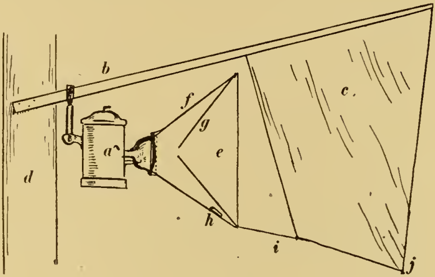


Fig. 3 Trap lantern used at Old Forge (trap shown in section) *a* An ordinary acetylene bicycle lamp, attached by its own clamp to the wooden arm *b*, which carries also the cloth leader *c*, and is itself nailed to the post *d*; *e* is the trap, made of an outer cone of tin, and an inner one of celluoid *g*; *h* is the cyanide package in the space between the cones; *i* is a cord and *j* a weight for keeping the leader properly hung.

New methods. Under this heading may be mentioned the use of two new pieces of apparatus that were designed for and first used in the field work of 1905; a new form of trap lantern, and a water tent trap for capturing water insects at transformation.

New form of trap lantern. The trap lanterns we used at Saranac Inn [described in N. Y. State Mus. Bul. 47, p.399] were efficient, but they were large and cumbersome, and difficult to carry from place to place. I desired a smaller one that could be readily carried afield, and set up and run anywhere. So, I adopted for the lantern part of it a small acetylene bicycle lamp and made a small round trap of tin and celluloid to attach to its front, and hung out a leader in front of it, as shown in figure 3. The whole was attached to a light wooden arm, which could be quickly fas-

tened to any tree or post by nailing. The whole apparatus weighed but a few pounds. For transportation the lantern was removable from the arm, and the leader rolled up about it.

The trap consisted of a truncated cone of light-weight tin [*f*], cut to fit inside the rim of the reflector of the lantern, and having three hooks for attachment that snapped on over the outward projection of the rim. Within the tin cone was another shorter and more truncated cone of celluloid [*g*], having the hole at its apex large enough to admit the largest of the insects desired to be captured. The two cones were of almost equal diameter at base, where they were fastened together by means of ordinary wire paper clips. No cyanide cup was provided, none being necessary; it was quite sufficient to place the cyanide well wrapped in absorbent paper in the space between the cones on the lower side, as shown at *h* in the figure.

The leader [*c*], hung out in front in the axis of the cone of light, is of advantage on two accounts: 1 It vastly increases the area of lighted surface, and this, as is well known, rather than the intensity of the light, determines the alluring power of the trap. 2 The leader serves as a convenient alighting place in front of the trap. And most of those that are trapped alight first upon the leader, and then jump directly into the celluloid cone and pass through the hole in its center, into the cyanide chamber. Moreover, swift-flying insects, which would sweep by a small trap and might not return again to it, are likely to be arrested by the leader. The leader we made of thin white muslin.

The weight shown at *j* in the figure, and the cord [*i*] extending back therefrom to the edge of the trap, are merely intended to keep the leader properly hung, and are not necessary except when a breeze is blowing or when the cloth is crumpled.

Given proper conditions of darkness and warmth, this trap lantern works excellently. Most photophilous insects alight upon the leader and pass directly from it into the trap where in a few seconds the cyanide fumes[1] quiet them. They accumulate in a layer on the lower side. This lantern is waterproof.

Let no one imagine that even the best trap lantern possible will make a good catch every night. The collector who has sugared for moths, or the teacher who has picked up laboratory material

[1] It should be more generally known that boracic acid crystals mixed with pulverized cyanide of potassium, cause an accelerated evolution of cyanide fumes, resulting in the killing of the captives more quickly and the preservation of the entire catch in better condition.

under street lamps will not need to be told that on many nights even in midsummer insects are not out to be caught. A few moths and midges may be expected almost any kind of a night, but warm sultry still nights preceding a downpour of rain are apt to be best. In the Adirondacks a dampness and chill often settle over the land just after sundown, putting an end to the prospects for good lantern work of many a promising afternoon. During our stay at Old Forge hardly more than a half dozen nights yielded a strictly first-class catch — a catch of thousands of specimens and of scores of different species.

A tent trap. Quite as an experiment, and without expecting any large results, we made a tent of cheese cloth [the one shown in plate 8] and set it directly in the bed of Beaver Meadow brook, just above the fish ponds, to capture and retain such winged insects as might upon transformation arise from the surface of the water beneath it. We anticipated that such insects would fly or climb up to the roof of the tent and remain there, attracted by the light above, and we thought that perhaps some of them might be collected thence more easily than they could be obtained in any other way. Our expectations were greatly exceeded.

The tent was made of cheese cloth, supported on three strong cords. The cloth was folded about each cord and sewed on the inside, so as to leave no small crevices into which the insects might crawl and hide. The ridge cord was stapled to the top of two stakes [*see* pl. 8], and anchored to stones at each end, and the two end cords were carried out at the sides and similarly anchored. The edges of the cheese cloth dipped into the surface of the water, and the two sides (upstream and downstream) that felt the force of the current, were anchored in place with stones. Thus secured, the tent withstood a number of freshets that occurred during the month it was in operation.

It covered a water area six feet square. The stream bed here was covered with stones of various sizes, mostly matted over with moss [pl. 9, fig. 1]. In a little preliminary collecting we had discovered that this moss sheltered some interesting stone fly and May fly nymphs, but we were not prepared to anticipate that such numbers of them as appeared in the tent later, could actually be present there.

The tent was set up on the 15th of August and maintained in operation for a month, its catch being removed daily, so long as other work permitted. Our first peep into it on the morning of

the 16th was a revelation. Insects of five orders in astonishing numbers had transformed beneath it, and were assembled under the ridge cord, waiting to be picked off. There were several square feet of Chironomidae in the top, and stone flies and crane flies and caddis flies and May flies were scattered all over the sides.

We found the gathering of all these specimens no inconsiderable task. It required usually more than an hour's diligent application for two of us every time. And this, added to other matters we had in hand, left us no time for investigating the relations these insects bear toward each other in the stream bed before their transformation. This account, therefore, of the insect life of Beaver Meadow brook is to be considered as a mere preliminary statement, giving only such data as were obtained with the aid of this tent trap. We believe that this trap will yield quantitative results within its proper field (winged insects with aquatic larvae) and that it is the first to be devised that is of any value for quantitative purposes. And we believe furthermore, that this collecting method is one of wider applicability. We think, for instance, that a water tent may be used for positive determination of the breeding grounds of various kinds of mosquitos, and of the relative numbers in which each kind is produced.

The yield of the winged insects from this area six feet square of brook bottom is shown in the following table:[1]

[1] I have recently made an improvement in the construction of the tent trap — one that greatly economizes the labor of taking out the catch. I make it now in pyramidal form with *opaque* sides supported on a solid frame, but with a hole at the top, over which I place a light bag of netting. The insects crawl up into this bag, which being detachable, may be exchanged in a moment for another, and with all its contents inserted into a large cyanide bottle.

Table of winged insects caught in a tent trap in Beaver Meadow brook, Old Forge, N. Y., July 16–August 15, 1905

		JULY														AUGUST						
		16	17	18	19	20	21	22	23	24	25	26	27	29	31	2	4	6	9	12	15	Totals
Perlidae	Chloroperla	15	13	10	15	11	15	13	17	9	10	3	12	14	14	16	8	25	13	27	17	277
Perlidae	Nemoura	2	3	10	6	12	4	6	8	11	12	1	13	15	15	17	12	22	13	10	12	204
Perlidae	Leuctra	6	5	7	10	6	4	4	5	2	9	1	2	10	11	17	27	74	134	150	67	551
Ephemeridae	Baetis	16	14	10	28	4	9	15	12	36	25	9	9	18	10	7	9	27	12	1	0	271
Ephemeridae	Ephemerella	4	0	1	4	1	0	0	2	0	0	0	0	0	0	0	1	0	0	0	2	15
Ephemeridae	Leptophlebia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	4
Ephemeridae	Heptagenia	3	2	1	1	1	0	1	2	2	3	0	1	2	1	0	1	0	2	1	0	24
Trichoptera	Rhyacophilidae	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	4
Trichoptera	Hydropsychidae	5	2	0	7	0	3	3	7	5	5	3	1	7	2	2	0	1	0	1	1	55
Trichoptera	Sericostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	2	2	6	4	12	10	10	3	49
Trichoptera	Limnophilidae	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Diptera	Psychodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	4	10
Diptera: Tipulidae	Tipula	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Diptera: Tipulidae	Rhaphidolabis	2	6	2	7	0	2	0	2	4	0	0	1	2	1	0	0	1	2	4	5	41
Diptera: Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	22	25	0	52
Diptera: Tipulidae	Dicranomyia	1	4	4	1	3	0	0	1	0	0	0	0	1	0	2	0	1	1	1	3	23
Diptera: Tipulidae	Misc. Tipulidae	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	5
Diptera	Simuliidae	15	5	2	7	3	5	3	1	0	7	2	3	4	5	2	4	9	10	8	5	100
Diptera	Culicidae	1	1	1	1	1	1	1	3	1	0	0	0	0	1	0	0	0	1	1	0	14
Diptera: Chironomidae	Ceratopogon peregrinus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	51	67	128	97	347
Diptera: Chironomidae	Orthocladius sordidellus	202	75	70	80	10	38	36	57	42	95	21	66	48	4	15	54	40	70	90	30	1 143
Diptera: Chironomidae	Tanypus hirtipennis	27	10	7	25	3	9	15	6	18	20	9	12	29	4	2	2	8	6	12	5	229
Diptera: Chironomidae	Misc. Tanypus	0	0	0	0	0	0	0	0	0	0	3	1	3	1	1	1	3	1	1	1	16
Diptera: Chironomidae	Procladius bellus	0	0	0	0	0	0	0	0	0	0	1	1	14	2	7	1	7	5	0	0	38
Diptera: Chironomidae	Misc. Chironomus	3	4	2	4	5	1	2	5	0	1	4	7	4	4	0	7	3	15	27	8	106
Diptera: Chironomidae	Thalassomyia obscura	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Diptera	Tabanidae	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9	1	0	11
Diptera	Empididae	7	1	3	1	0	2	3	9	11	16	8	8	9	12	5	12	12	8	27	21	175
Diptera	Dolichopodidae	0	0	0	1	1	2	1	3	5	2	2	1	8	2	0	4	0	0	4	1	37
Diptera	Scatophagidae	0	0	0	0	0	0	1	0	0	0	4	2	2	1	2	8	4	0	10	2	36
																						3 844

Before setting up this tent we had done some desultory collecting from the bed of this stream, but we had found the immature stages of only a few of the insects that the tent trap revealed. We had found those stone fly and May fly nymphs that live amid the moss that covers the submerged stones [*see* pl. 9, fig. 1]. This is a soil-gathering moss that grows in tufts, so matted together that a bottom layer of fine sand and silt is held closely about the stone, even when it is exposed to the wash of the current. The stone flies of the genus Chloroperla and Leuctra were found in this moss, and the May flies of the genus Ephemerella. There were two species of Chloroperla: the common widely distributed C. bilineata Say, and another larger, apparently undescribed species. The latter was less abundant, 23 specimens being taken in the tent between July 17 and August 2. Both species climbed up the sides of the tent (the lower edges of which dipped into the surface all around) to transform, leaving their empty skins sticking to the cheese cloth anywhere from a few inches to a few feet above the surface of the water.

The May fly Ephemerella was also a new species. It is described on a subsequent page as E. dorothea. Its nymphs lived down between the moss stems on the surface of the soil beds covering the stones. The nymphs of Baetis disported themselves more openly in the edges of the current. These are exceedingly agile little creatures. The nymphs of Heptagenia clung, as is their wont, to the under surfaces of bare stones.

The caddis flies that appeared in the tent were fewer in individuals but they represented a much greater number of species. There were three species of Ryacophilidae; eight of Hydroptilidae; two of Sericostomatidae, and one of Limnophilidae. These are all in Dr Betten's hands and will be noticed in his bulletin, now in preparation, on New York Trichoptera.

The order Diptera was represented by no less than nine families, and two of these, the Tipulidae and Chironomidae, are of very great importance in such situations, while two Psychodidae and Culicidae are of slight importance: this is not the type of aquatic situation suited to their development. In the Tipulidae, the great abundance of three species, Rhaphidolabis tenuipes, Antocha opalizans and Dicranomyia defuncta was especially noteworthy. The Tipula, represented by but two female specimens, remains undetermined. Those put under "miscellaneous" in the table were Rhipidia maculata, repre-

sented by five specimens taken in August, one Limnobia parietina taken on the 15th of August, and one Helobia punctipennis taken on the 20th of July.

The black flies (Simuliidae) were doubtless much less abundant than they would have been if our tent had been set over the brink of a waterfall — the favorite home of their larvae. But few moth flies (Psychodidae) were taken, 10 specimens in all, and these all in August. Mosquitos (Culicidae) likewise were few, 14 in all, distributed with considerable regularity over the entire month.

Midges (Chironomidae) appeared in surprising abundance and variety. The full list of the species taken is given in Dr Johannsen's supplementary report, published herewith. The numbers of individuals given in the table, although very large, are much smaller than they would have been, but for depredations of some of the larger flies (especially Hemerodromias) and spiders, which managed to find their way in. The tent flaps were folded and then pinned as closely as possible; but the small spiders, which came presumably from the overhanging boughs of adjacent shrubbery, would get in, one or two of them almost every day, and up in the angles of the tent under the ridge cord, they obtained a maximum of food with a minimum of effort. It was the more delicate little pale species that suffered most from these depredators.

The Tabanidae taken in the tent were very few: 1 specimen of Chrysops vittatus, and 10 (in August) of an undetermined species of Tabanus.

The Empididae were all of two species: Hemerodromia valida and H. scapularis. These made themselves very much at home in the tent. They were to be seen constantly eating the little yellow midges of the genus Orthocladius, or occasionally a larger Tanypus or even a Chironomus as big as themselves.

The remaining three families of Diptera were represented each by single species: the Dolichopodidae by Dolichopus scoparius; the Scatophagidae by Cordylura capillata and the Anthomyiidae by an undetermined species of Pegomyia.

There can be no doubt that nearly all these forms listed lived as larvae in the water or on the stones beneath the tent. There is a possibility that a few of those most sparingly represented may have found their way in as did the spiders, by working between the flaps. I think it probable that some of the mosquitos followed

us in when we entered to take the catch, for I saw one riding in on the back of Dr Betten's neck. They were abundant outside and very hungry, and during the hour or more required to secure all the specimens that had appeared since a previous visit, we did not fold and pin the flaps very carefully. During the month about half a dozen beetles and about as many Hemiptera appeared in the tent—usually single specimens: but as these were nonaquatic forms such as were common in the surrounding woods, we have not listed them in the table; they may have fallen into the stream and been washed under the tent by the rapid current.

The table gives the totals for each species or group of species. These numbers were in some cases a great surprise to me. Note for example, the number of specimens of the stone fly Leuctra. Our biggest collections in museums contain usually but a few specimens of this genus (if they have any at all). I had in 1905 accumulated in my own collection, after several years of collecting stone flies, about a score of specimens. Here on the 12th of August we took 150 specimens from the tent at one picking, and it yielded 351 specimens in all.

The grand total of 3844 specimens represents the yield in adult insects of six feet square of this brook for a month. The mile of this little stream that was of quite similar character certainly furnishes a quantity of insects that, however weighed, measured, or estimated, is very considerable.

We deeply regretted and still regret that there remained no time to us for investigating the ecological relations of these forms in the brook bed; but we believe that the facts of the table justify the large amount of labor that was necessary to collect, preserve, study and classify all these specimens.

Studies on fish food

Out of the weed patch by the hatchery wharf, where, as already noted, we collected oftenest and where we knew the life conditions best, we took a number of common fishes for the purpose of studying their food. These belonged to the three species that appeared to be most common there; the common bullhead, Ameiurus nebulosus; the common sunfish, Eupomotis gibbosus and the red-bellied minnow, Chrosomus erythrogaster. Food determinations were made by the only reliable method yet devised — the microscopic examination of the contents of the alimentary canal. While the food of these three species has been

reported on before, the data are insufficient, and have been derived from specimens collected at random, and with little knowledge of feeding grounds or conditions. Forbes's report on the food of the red-bellied minnow, for example, is based on the examination of three specimens. We believe that the results of this present food examination, as given in the following tables, justify the great amount of labor that is involved in all such studies.

Table I Food of 25 bullheads from Old Forge pond

NUMBER	FISHES			DRAGON FLY NYMPHS					
	Sunfish	Horned dace	Undetermined fish	Aeschnidae	Libellulidae	May fly	Crawfish	Algae	Silt
1	....	....	*	....	....	....	....	....	*
2	1	....	....	1	....	....	....	....	.....
3	1	....	....	....	....	....	....	....	.....
4	2	....	....	....	....	....	....	....	.....
5	1	....	....	....	....	....	....	....	.....
6	1	....	....	....	....	....	....	....	.....
7	1	....	....	....	....	....	....	....	.....
8	1	....	....	....	....	....	....	....	.....
9	1	....	....	....	....	....	....	....	.....
10	....	....	....	*	....	....	1	*	.....
11	1	....	....	....	....	....	....	....	.....
12	1	....	....	*	....	....	....	....	.....
13	....	....	....	....	....	....	....	....	.....
14	1	....	....	1	....	....	....	....	*
15	1	....	....	....	....	....	....	....	.....
16	1	2	....	....	....	....	....	....	.....
17	....	1	....	....	....	....	....	....	.....
18	....	....	....	....	....	....	....	....	*
19	....	3	....	....	....	....	....	*	.....
20	....	....	....	....	....	....	....	*	.....
21	....	....	*	....	2	1	1	....	.....
22	3	....	....	1	....	....	....	....	.....
23	....	....	....	1	....	....	1	....	.....
24	....	....	1	....	....	....	....	*	*
25	....	1	....	....	....	....	....	....	...
Total..	17	7	3	6	2	1	3	4	4

The bullheads of the foregoing table were adults, the smallest being about 8 inches in length. Of the 25 specimens studied, all but 1 had eaten other fishes of some sort. 17 of those eaten were small sunfishes between 2 and 3 inches in length. Six

were horned dace of about the same size, and 3 were unidentifiable. The 25 bullheads had eaten at least 26 other fishes, all of practically the same size.

Seven fish had eaten large dragon fly nymphs, of which 6 belonged to the family Aeschnidae, and 2 had eaten Libellulidae. One fish only had eaten a May fly nymph and 3 had eaten small crawfish less than 2 inches in length. Three had eaten small filamentous algae (Spirogyra, Zygnema and Cyanophyceae) and only 4 had eaten any appreciable quantity of silt.

Food constituents individually considered. By far the most important single element of bullhead food at this time and place was small sunfishes. These abounded everywhere among the submerged aquatic plants growing on muddy bottoms. They were taken by small boys in minnow traps and by ourselves when collecting with sieve nets. There must be fearful decimation in numbers of young sunfishes in submerged pastures infested by bullheads. Horned dace are also very common about the borders of these same water-weed patches and are likewise taken in minnow traps and seines.

Although the bullheads lie on the bottom, the dragon fly nymphs eaten did not show them to be bottom feeders. The nymphs of the Aeschnidae habitually climb about over the stems of water weeds and are rarely found on the bottom. They are protectively colored and are hardly noticeable when at rest, but swim away with a jerky gait produced by successive ejections of the water from the gill chamber; and when once dislodged and set going they are no doubt captured easily by the bullheads. The nymphs of the Libellulidae are typical bottom sprawlers. Only two of these were eaten, however. They lie concealed amid the bottom silt and it is only when they are brushed out of place that they kick actively and are easily found. The single May fly represented, of course, a very insignificant part of the total food taken, but neither is it a bottom form. While not clearly identifiable it was certainly one of the climbing nymphs of the Baetinae. Crawfish diet was proven by the presence of two small nipper feet. These, indeed, are typical bottom forms; and their habit of jumping backwards when disturbed and evading their enemies in a cloud of sediment, or fleeing into hiding under a stone, is, of course, well known to every one. Small quantities of algae and of silt were eaten; so small, in fact, that they might very well have been taken quite accidentally in the quest for other food, and there is no evidence whatever

that any of the animals eaten were dead when found. This certainly does not indicate the scavenger habits that have been very frequently ascribed to bullheads.

Sunfish food

Pursuing the matter a little farther we examined the food of 25 sunfishes (Eupomotis gibbosus), taken at the same time and place as the bullheads, that is, July 10th, in the weed patch off the hatchery wharf at Old Forge pond. We selected, of these, three sizes in order to determine if there were any appreciable change of food with age of fish. The largest examined were approximately three inches in lenth (lot 1), and the next in size about two inches (lot 2) and the smallest were between three fourths of an inch and an inch in length (lot 3). All were taken together. The results of examination are given in the following table:

Table II Sunfish food

NUMBER		INSECTS					CRUSTACEANS					ALGAE	SILT	MISCELLANEOUS
		Beetles	Caddis fly larvae	Midges larvae	Midges pupae	May fly nymphs	Copepoda	Cladocera	Ostracoda	Water mites	Snails			
1st lot 3 inches in length	1	....	....	....	....	....	....	....	....	....	....	....	....	....
	2	2	....	1	....	....	....	†	....	....	....	....	....	....
	3	....	2	1	....	....	....	....	....	....	....	....	....	dragon fly n.
	4	....	....	2	....	....	*	....	....	....	....	*	....	....
	5	1	2	1	....	3	....	....	....	....	....	....	....	water skater
	6	....	....	....	....	13	....	....	....	....	....	....	....	....
	7	....	....	1	....	....	....	....	....	....	....	....	....	....
	8	....	....	6	....	....	....	....	....	....	20	*	....	....
2d lot 2" inches in length	9	....	....	1	....	....	*	*	....	....	†	....	....	....
	10	....	....	2	1	1	*	*	....	1	†	....	....	....
	11	....	....	....	....	1	*	....	....	....	†	....	....	....
	12	....	....	1	....	....	*	†	....	2	....	....	....	....
	13	....	....	1	1	2	*	....	....	....	*	....	....	Rotifer
	14	....	1	1	1	....	*	....	....	1	....	....	....	....
	15	....	....	1	....	1	†	*	....	1	....	....	....	....
	16	....	....	13	....	....	†	....	1	....	....	....	....	....
	17	....	....	....	1	1	....	*	....	....	....	....	....	....

3d lot ¾ inch to 1 inch in length........	18	....	....	†	....	....	†	1	1	1	....	....	....	....
	19	....	....	2	....	....	*	....	....	....	....	....	....	....
	20	....	....	*	....	....	†	*	....	....	....	....	....	....
	21	....	....	....	....	....	†	1	....	....	....	....	....	....
	22	....	....	1	....	....	†	1	....	....	....	....	....	....
	23	....	....	1	....	....	†	....	....	....	....	....	....	....
	24	....	....	2	....	....	†	....	....	1	....	....	....	....
	25	....	....	....	....	....	†	*	....	....	....	....	....	....
Total first lot....		3	4	12	....	16	1	1	....	....	1	2	1	
Total second lot..		....	1	20	4	6	8T	5T	1	5	4T	....	....	
Total third lot....		....	....	6T	....	....	8T	5T	1	2	....	....	....	

* Occurred in fragments. † Occurred in abundance. T=Times occurring.

The food differences of the three groups are interesting and significant. That of the smallest lot (too small, judging by the preceding study, to be selected by bullheads for food) was predominantly Entomostraca, especially Copepods, with a considerable proportion of midge larvae. The food of the second lot was predominantly small snails and midges, with an occasional abundance of Copepods. The food of the larger ones was predominantly May flies, and midge larvae and pupae, with a sprinkling of other insects. Indeed, the table understates the difference between the food of the three lots for the midge larvae eaten by the fishes of lot three were as a rule much smaller than those eaten by the larger fish.

Notes on the constituents of the food. The beetles eaten were all adults. They were eaten only by the larger fish. There were but three of them, however; a ground beetle by number 5 (and this may have fallen into the water by accident), and 2 Parnid beetles by fish number 2. Beetles of this latter family are very commonly found crawling about on the under surface of submerged logs or hiding in their crevices. They stick closely to the surface, their long legs widely outspread, and they hold fast with their huge grappling claws and are not easily dislodged.

Only five larvae of caddis flies were eaten, and these appeared to have been separated from their cases, not swallowed in them as were those fed upon by the brook trout of Bone pond at Saranac Inn [*see* N. Y. State Mus. Bul. 68, p. 204]. No case construction material was found with them, but the larvae appeared to be such as usually construct their cases out of plant stems. They have been preserved for future determination.

Midges on the contrary (family Chironomidae) formed a large percentage of the food of the sunfish of all sizes. The smaller larvae, however, were eaten by the smallest fish, as already noted, and the larger larvae and pupae, only by the larger ones. Every study of fish food hitherto made has emphasized the great ecological importance of this group.

No May flies were eaten by the fish of lot three, but the larger fish had eaten them very freely — two of them (number 6 and 16) in great abundance. Number 2 had eaten a burrowing nymph of the genus Ephemera along with a dozen Caenis. All the others eaten by all the fishes were Caenis diminuta. This is the little white May fly already mentioned as swarming to our trap lantern when set on the hatchery pier. It is the most ephemeral of all Ephemera. It emerges from the water at nightfall, leaving

its nymphal skin floating on the surface, and, alighting on the first support that offers, sheds its skin again, and the subimago stage is ended. Then it flies for a little while, the males dancing up and down in a little swarm, as in other species, and the females coming out to meet them. It probably lives in all but a few hours of adult life. I have frequently watched the swarming until it was entirely obscured by darkness. Specimens of this species emerging from the hatchery troughs at Saranac Inn deposited their eggs in little clusters of 200 to 300 upon the window panes.

The nymphs of this little May fly abound wherever there are beds of waterweeds. They rest upon the silt covered bottom or cling to the stems of the plants. They cling closely and, being entirely covered with silt, are quite unobservable except when dislodged. Because they cling so closely they are not easily collected nor easily separated from the trash. That they exist in inconceivable vast numbers is demonstrated most readily by the use of a trap lantern. Our lanterns at the pier were sometimes almost choked with them and thousands besides were found upon the supporting post and upon the lantern itself outside; and this condition of things has prevailed in every locality of the United States in which I have run a trap lantern over still water. I have no doubt that these very minute nymphs, too small for proper food for the larger fishes, are of very great importance to young fishes and to the smaller species. They are scarcely mentioned hitherto, however, in the literature of the fish food.

Only two other insects were found; a half grown nymph of a dragon fly of the genus Aeschna, that was eaten by fish number 3, and a water skater, by fish number 5.

Of the crustaceans eaten, all were Entomostraca. But three were Ostracods, and these were eaten singly. Copepods were eaten abundantly by the smaller fishes of lot three, sparingly by those of larger size. I was unable to determine any of them. Apparently there were but few species. The great importance of Copepods as food for young fishes has been abundantly demonstrated hitherto through the labors of others. Nevertheless, the conditions that make for their abundance are scarcely at all understood. Cladocera were eaten as a rule very sparingly, only one fish (number 12) having eaten any great number; it had eaten almost exclusively a species of Bosmina. The others so sparingly eaten belonged to the genera Alona and Chydorus.

Water mites of several species were eaten; but sparingly, as indicated in the table, and they formed no considerable part of the food total.

Smaller snails one or two millimeters in diameter were eaten in large numbers by five of the fishes of intermediate size (fish number 7 of the first lot being the smallest of that lot). These were not certainly determinable since the delicate shell of these young snails is very quickly dissolved in the digestive secretions; but they were certainly right-hand spires and apparently belonged to the genus Limnea.

No other groups of animals were represented save Rotifera by a single smooth lorica found in fish number 13. Only one fish had eaten silt, and in all, but two bits of algae were eaten, both clearly recognizable as belonging to the genera Chara and Nitella.

Food of the red-bellied minnow

That there is much need of the further study of the food of the smaller species of fishes — those that furnish the supply of the larger and more important ones — has long been perfectly clear. Carnivorous forms can not live by eating each other indefinitely; it is obviously important to locate the primary supply. The food of all organisms upon which fishes feed needs to be carefully studied. Of the smaller fishes of Old Forge pond the red-bellied minnow was most in evidence; its habits, however, have already been mentioned. The food of 12 specimens of this species taken near the hatchery pier along with the bullheads and sunfish already discussed, was carefully examined with the microscope. The food constituents were tabulated as far as tabulating was possible, but since it subsists almost wholly on vegetable materials, green algae, and disintegrating fragments of aquatic seed plants, accurate numerical statement was impossible. The results of this examination are therefore given broadly as follows:

Of the 12 minnows examined all had eaten both green algae and dead waterweeds, and in but two of them could I discover the remains of any animal whatever (fragment of the nymph of the genus Caenis in one, and half of a small midge larvae in another). All but one had eaten Spirogyra and five had eaten it in great abundance. The only other algae eaten abundantly was an undetermined spherical gelatinous tetrasporoid form which was recognized in five cases and was abundant in two of them. There was more or less unrecognizable silt in every case, and scattered through this were

Diatoms in a considerable variety, filaments of Cyanophyceae and Desmids (among which the genera Closterium and Desmidium were recognized). All of these occurred sparingly and may very well have been taken along with the disintegrating stems and leaves of the higher plants.

This last mentioned material was in four cases a mass of leaf fragments of a slender species of river weed (Potamogeton) and in three other cases it contained (once in excess) remains of the petiole of the yellow water lily (Nymphaea advena). These were recognizable by the well preserved internal hairs from the walls of the air chambers. Such food stuff was, of course, very abundant in this place. There may have been a good many other plants present, indeed I have no doubt there were some others; for a form of tracheids quite unknown to me, derived from the vascular bundles of some other seed plant, occurred three times.

These were the predominating elements of the food, however; they show that at this time and place Chrosomus was a vegetable feeder. Apparently this singularly beautiful and hardy little fish is one that can be introduced safely into private ponds.

I hasten to place beside the foregoing, the results of a more extensive study of the food of this fish, made in quite a different situation, and so different in kind that they will teach the necessity of great care in reaching conclusions as to what fishes eat.

A former pupil of mine, Mr Warren H. Ferguson, studied the food and feeding habits of Chrosomus in Pettibone creek, near North Chicago, Ill., in 1904. The place has since become the site of the United States Naval training station of the Great Lakes. The creek was then a beautiful little stream flowing through fine oak woods with here and there a deep shadowy pool and with intervening stretches of flowing water. It was one of my favorite collecting grounds when I lived at Lake Forest, 6 miles distant. A few other fishes live in the stream; the horned dace, a little stickleback, several darters, and very small suckers, but none were so abundant as Chrosomus; and only the darters that live in the riffles were as constantly to be found in a given place.

The forage offered by this creek was very different indeed from that of Old Forge pond. Here there were no standing aquatics and no unattached filamentous algae. Rocks and sticks exposed in the riffles were draped with two beautiful sessile algae (Draparnaldia plumosa and a species of Cladophora). The outlet of every pool was choked, and every obstruction was covered

with a mass of dead forest tree leaves. Among these leaves, where submerged, dwelt an abundance of amphipods. In these leaf drifts too, especially after every freshet were to be found many earthworms, dislodged from the banks by the undercutting of the current, and stranded here.

The plankton of the pools was not rich, but it contained a goodly proportion of Entomostraca chiefly salmon-tinted Diaptomus and a considerable variety (though a small proportion) of Rotifers, and a few Heliozoeans, and a few Peridinia and other flagellates, many Diatoms of a few species, and a variable proportion of small midge larvae. The bottom and sides of the pool sheltered midge larvae, and May fly nymphs of the genus Leptophlebia. Besides the red-bellied minnow, the only other important competitors for the scanty food the pools offered were the horned dace, and large dragon fly nymphs of the bottom belonging to the genus Cordulegaster [*see* account of these in *Entomological News*, 16:3–6].

The minnows lived in the pools, playing out on the shoals in little resplendent groups when the coast was clear, and retreating to the deep places and to the shelter of undercut banks when danger appeared.

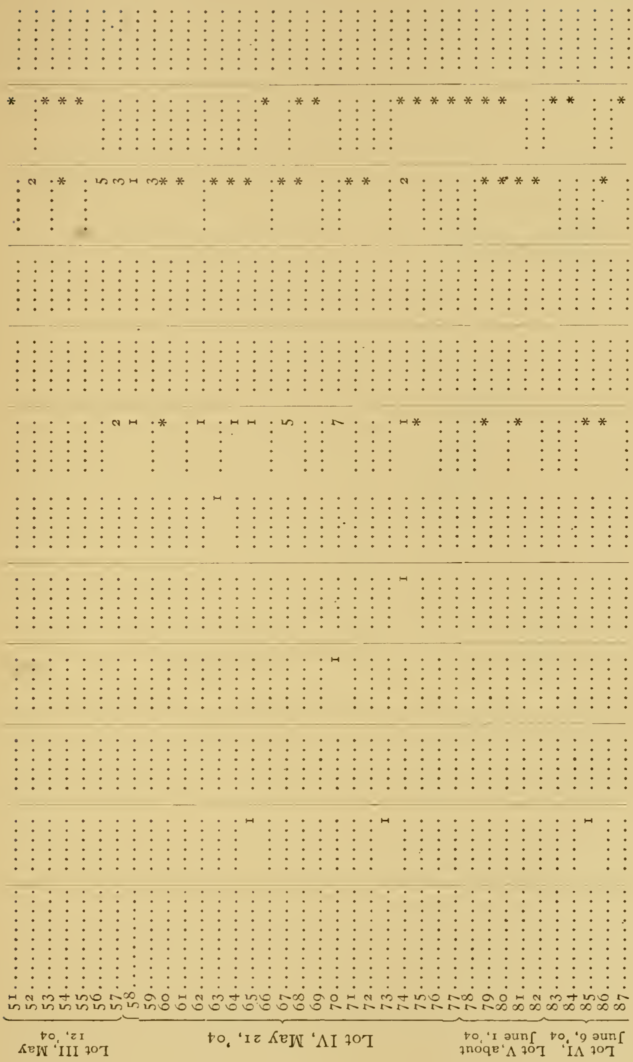
Mr Ferguson studied them here through April, May and the first part of June. He made six collections of the minnows for food examination of stomach contents and prepared the following table. The things eaten are indicated by numbers in this table when individuals could be certainly counted. When they could not the occurrence of their remains is indicated in the table by a *.

Food of Chrosomus erythrogaster

	NUMBER	INSECTS						CRUSTACEANS				
		Beetles	May fly nymphs	Ants	Chironomids larvae	Chironomids pupae	Chironomids adults	Entomostraca	Amphipods	EARTHWORMS	SILT	ALGAE
Lot I, April 25, '04	1		*								*	*
	2							*			*	*
	3	1									*	*
	4						4				*	*
	5								*		*	
	6										*	*
	7										*	*
	8							*			*	*
	9										*	*
	10							*			*	*
	11										*	*
	12										*	*
	13						5				*	*
	14										*	*
	15											
	16						6				*	*
	17										*	*
	18										*	*
	19								*		*	*
	20										*	*
	21										*	*
	22							*			*	*
	23										*	*
	24								*		*	*
	25											

Food of *Chrosomus erythrogaster* (continued)

	NUMBER	INSECTS: Beetles	INSECTS: May fly nymphs	INSECTS: Ants	INSECTS: Chironomids larvae	INSECTS: Chironomids pupae	INSECTS: Chironomids adults	CRUSTACEANS: Entomostraca	CRUSTACEANS: Amphipods	EARTHWORMS	SILT	ALGAE
Lot II, May 1, '04	26	......	......	*	......	......	......	......	......	......	*	*
	27	......	......	......	......	2	4	......	......	......	......	......
	28	......	......	......	......	......	1	......	......	......	*	*
	29	......	......	......	......	5	5	......	......	......	*	*
	30	......	......	......	......	......	1	......	......	......	*	......
	31	......	......	......	......	......	1	......	......	......	*	......
	32	......	......	......	......	......	......	......	......	......	*	*
	33	......	......	......	......	*	*	......	......	......	......	......
	34	......	......	......	......	*	*	......	......	......	......	......
	35	......	......	......	......	*	*	......	......	......	*	*
	36	......	......	......	......	*	*	......	......	......	*	......
	37	......	......	......	......	*	*	......	......	......	*	......
	38	......	......	......	......	*	*	......	......	......	*	......
	39	......	......	......	......	......	*	......	......	......	*	*
	40	......	......	......	......	*	*	......	......	......	*	*
	41	......	......	......	......	*	*	......	......	......	*	......
Lot III, May 12, '04	42	1	......	......	......	......	......	......	......	1	......	......
	43	......	......	......	......	......	2	......	......	1	......	......
	44	......	......	......	......	......	......	......	......	1	......	......
	45	......	......	......	......	......	......	......	......	......	*	......
	46	1	......	......	......	......	1	......	......	1	......	......
	47	......	......	......	......	......	......	......	......	......	*	......
	48	......	......	......	......	......	......	......	......	1	*	......
	49	......	......	......	......	......	......	......	......	1	......	......
	50	......	......	......	......	......	......	......	......	3	*	......



51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Lot III, May 12, '04
Lot IV, May 21, '04
Lot V, about June 1, '04
Lot VI, June 6, '04

Food of Chrosomus erythrogaster (concluded)

NUMBER		INSECTS						CRUSTACEANS		EARTHWORMS	SILT	ALGAE
		Beetles	May fly nymphs	Ants	Chironomids larvae	Chironomids pupae	Adults	Entomostraca	Amphipods			
Lot VI, June 6, '04	88	......	......	......	......	......	*	......	......	*	......	*
	89	......	......	......	......	......	......	......	*	*	*	....
	90	......	......	......	......	*	......	......	......	......	......	....
	91	......	......	......	......	......	......	......	......	......	*	....
	92	......	......	......	......	......	*	......	......	*	......	....

The following is Mr Ferguson's summary of his results:

The table shows at a glance that practically all the food of lot 1 consisted of silt and algae. The explanation for this is that other food, such as midges and worms was scarce so early in the year. Spring rains had not yet brought down the earthworms. About half of the food of lot 2 was silt and algae, while the other half was pupae and adult midges. In only three of the fish was it possible to say how many midges they contained, hence the stars in the table. Only three out of 16 fishes of lot 3 contained midges, while all but four contained earthworms and half of them contained a large amount of silt. Lot 4 shows a large number of adult midges of the genus Chironomus (apparently most of them of the species of which the appendages are shown in figure 4*a*) and many earthworms. And one of them contained a single large mass of Chironomus eggs — the only instance in which these were found. Lot 5 shows one adult Chironomus, and earthworms and silt predominate again in lot 6.

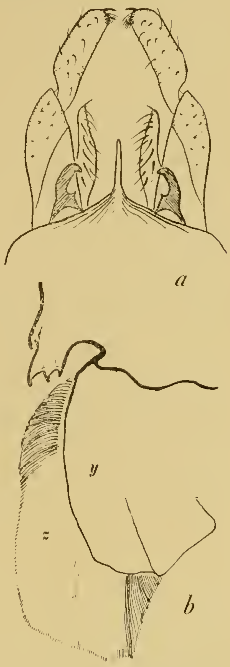


Fig. 4 The midge most commonly eaten by Chrosomus in Pettibone creek. *a* caudal appendages of the adult male, dorsal view. *b* one half of tip of abdomen of the pupa. *y* one half of the caudal fin, and *z* its fringe

Out of 92 stomachs examined, 38 (41 per cent) contained midges in one stage or another, 27 (29 per cent) contained earthworms, 6 contained beetles,— all adult beetles of nonaquatic habits. Three contained Entomostracans, two contained ants, and only 1 contained a May fly nymph. This clearly proves that Chironomus was by far the most important food.

After discovering the importance of midge larvae in the food of this minnow, Mr Ferguson began a feeding experiment to determine how many such larvae could be disposed of by the fish as a regular diet. He divided the tank of an aquarium table into two compartments, placing two full-grown Chrosomus in one of them and three others about half as large in the other. A piece of board was kept floating on the surface of each to furnish congenial shadow, and the white enamel bottom of the tank was kept clean so that uneaten food could be found. Midge larvae (nearly all those of Chironomus viridicollis,

averaging perhaps two thirds grown) were thrown into the tank twice daily in sufficient numbers so that each day a few remained over, uneaten. They were simply thrown on the bottom where they were snapped up promptly so long as the fish were hungry. The number disposed of during the preceding interval was recorded at each feeding. The average number eaten by the half grown Chrosomus was 11 per day, by the full grown ones, 25 larvae per day. The largest number was disposed of at the first feeding, but the figures were maintained fairly uniform after the third day; evidently these larvae are choice food for Chrosomus. The experiment was abandoned after 22 days because of the great difficulty found in supplying sufficient Chironomus larvae.

That the adult midges are quite as attractive food for Chrosomus as are the larvae is indicated by the following field observations made by Mr Ferguson:

It is very interesting to watch the fish feeding. The midges hovering over the water seem to attract them most. Usually the minnows are satisfied to wait till the midges touch the surface of the water, but quite often they spring several inches out of the water to catch them.

NEW DATA CONCERNING MAY FLIES AND DRAGON FLIES OF NEW YORK

May flies

(*Ephemeridae*)

Under this heading will be included a brief account of the May fly fauna of Old Forge, and descriptions of a few new forms collected by Dr C. Betten at Buffalo and vicinity in the summer of 1906. At Old Forge, May flies were abundant, and no place in which I have ever collected better exemplifies the need of different methods, and of collecting from different types of situation, and at different hours of the day, if one would really know the May fly fauna. There was a very familiar group of species (Siphlurus, Epheremella, Heptagenia etc.) that settled upon the outside of the hatchery and that could be found anywhere about the banks of Old Forge pond where shelter and good resting places offered. Then there were some others (Caenis, Chloeon) that were only to be found at night at the time of their emergence from the water. A few, like Leptophlebia, Chloroterpes and Baetis could be found on still afternoons swarming in great companies in the hollows of the wood, especially over little pools or in their vicinity, and there

was one (Ephemerella dorothea) that was only to be obtained by rearing it from the nymph, it being very secretive as to its adult habits. I collected chiefly by hand from the hatchery walls, by trap lanterns at Old Forge pond and on Moose river, and by sweeping nets along the banks of Beaver Meadow brook, and along the Adirondack League Club road to Little Moose lake. In a breeding cage maintained in a hatchery trough by my window, I reared a considerable number of May fly nymphs, verifying the breedings of former years, and adding a few new life histories, that will be given in the following pages:

Siphlurus alternatus. This species was common in trashy places in the borders of the ponds. I found the nymphs abundant in Bald Mountain pond. Adults were taken hovering at First lake on June 24th in mid afternoon. They settled in hundreds on the outside of the hatchery and could be taken constantly through June and July.

Blasturus cupidus. But few specimens of this elsewhere common species were seen. One was taken on the hatchery the first of July and several on piers about Old Forge pond in the latter part of June.

Leptophlebia mollis. This was another very common species. The nymph lived in slow-flowing clear streams, perhaps in other places as well, for I found the adults everywhere. A few at the hatchery; swarms of them on the Mountain Lodge "carry" opposite Dog Island in First lake, where they were flying underneath a high canopy of birch boughs, rising and falling in rapid succession through a distance of 25 feet, scarcely descending within 50 feet of the ground. I found them in Beaver Meadow brook, both in the meadow itself, and in the rocky part of the stream, at the fish ponds where four of them emerged within my tent trap. Nymphs taken from the stream at this place were reared in the hatchery on the sixth of August.

Callibaetis hageni. This species was common at the hatchery inside as well as outside, and during the latter part of July and the whole of August, subimagos could be collected in the hatchery windows. Adults could be picked up from the piers about the border of Old Forge pond. These specimens appeared to differ in no respect whatever from others obtained from the type locality in California.

Baetis posticatus. This delicate little May fly was to be found in the same situations with Leptophlebia. It was abundant

through July and August. It emerged in considerable numbers, as shown by the preceding table, from my tent trap, 6 square feet of the bottom of Beaver Meadow brook, yielding 271 specimens in a single month. This is the species previously mentioned as giving such a beautiful example of the May fly dance under the birch trees at the crossing of the Beaver Meadow brook by the Adirondack League Club road.

Chloeon mendax and C. vicinum. These two delicate little May flies (and a third apparently undescribed) were obtained with a trap lantern near the foot of First lake just after nightfall. Dr Betten and I rowed up to First lake on several evenings that bid fair to furnish good trap lantern collecting, and just at nightfall before the chill that is characteristic of the Adirondack evening had settled down, a few of these specimens came to light to reward our effort. Later in the evening no more could be obtained, but we had reason to believe that they were not uncommon at that place.

Ephemerella dorothea n. sp. This species lives in Beaver Meadow brook, amid the soil gathering moss that covers the stones there, as described in the account of our tent trap. Adults were obtained only by rearing them, and this notwithstanding their abundance, as evidenced by the abundance of their nymphs at that place. We did much collecting along the banks of that brook, sweeping the vegetation with nets, all up and down it, and not a single adult specimen was encountered. It was the sort of May fly easily to be overlooked, not alone on account of its habits, but also because of its general appearance. The best specimens that I have obtained of these are when fully mature, exceedingly fragile and have very little color. They look at first glance much like poor specimens of some of the stronger species. I append a description of both nymphal and adult stages.

Imago. Length, 5 to 6 mm; expanse, 15 to 18 mm; setae of the female, 8 mm; of the male, 8 to 9 mm; first femur of male, 7 mm; of the female, 4½ mm; a small yellowish species, pale even when fully mature, somewhat darker on the dorsum of the head and the abdomen, with hyaline iridescent wings, and pale yellowish white legs; infuscated only on the tips of the tarsi. Caudal setae white; forceps of the male, stout, the long second segment regularly tapering to near the apex, there suddenly internally dilated in a rounded knob. The first and third joints of the male forceps are of about equal length, each being about ⅛ of the length of the second joint, terminal joint subspherical. The ninth sternite of the female is produced in a broadly truncated lobe which projects posteriorly to the level of the posterior apex. The foretarsus of

the female has the second joint about equal to the third in length, and longer than the fourth which in turn about equals the fifth, and is about 3/5 of the length of the second. The basal joint (fused with the tibia) is about 1/4 as long as the second joint; tarsus and tibia are about equal length. The foretarsus of the male is longer than the tibia, and its third joint is longer than the second which about equals the fourth, and is twice the length of the fifth.

The wings are wholly hyaline (dull hyaline in the subimago) with weak cross veins. There are no accessory sectors in the median fork, but there are two behind the bisector of the cubital fork and the vein Cu_2 is more or less detached.

Nymph. Length, 7 mm, with setae 4 mm; antennae, 2 mm. This nymph is less depressed in form than others of the genus. Its colors are bronzy green and brownish, paler below and on all appendages, and sprinkled all over the dorsum with very fine pale dots or granulations. There is a pale line across the top of the head in front, and there is a pale dot on each of the fore angles of the prothorax, and another between the inner basal angles of the wing cases; antennae, pale, except the basal segment.

The body is widest on the mesothorax; the abdomen about as long as head and thorax together; the prothorax is wider than the head. Its sides are incurved anteriorly where they end in obtuse angles that project forward behind the eyes; the fore femur is much stouter than are the other femora, and darker in color externally; all the claws are strongly curved, and each is armed beneath with a comb of eight or nine pointed teeth. The abdomen is depressed, it lacks the double row of dorsal tubercles that is characteristic of other members of this genus. In outline it is ovate, widest on middle segment, and it tapers more or less abruptly from the eighth to the posterior end. Segments 8 and 9 terminate laterally in flat triangular spines. Gills are present on segments 3 and 7, and diminish regularly in size from the front backward. The inferior respiratory lamina of each is bifid, and its divisions are fimbriate-lamelliform. The covering lamellae on each of segments 2 to 6 overlaps only very slightly the base of the one immediately behind it. That of the 7th segment, however, is of small size and is wholly covered. The middle seta is longest, and all three setae are clothed basally with minute spines and bear long hairs in the middle portion, and are bare and darker colored at the tips.

This is the most generalized nymph yet made known in the Ephemerella group of May flies. None of its gill covers are wholly elytroid. It has no dorsal abdominal hooks. The thorax is high, almost compressed, and the abdomen is only moderately depressed.

I name this species in honor of little Miss Dorothy Burke, who played beside the delightful streamlet wherein I found it.

Caenis diminuta. This little white dusk-flyer abounds in every submerged weed patch, its close clinging, flat-bodied, silt-covered nymphs adhering closely to the fallen stems among which they clamber. It has already been mentioned in the preceding pages as swarming into our trap lanterns, as being found in the hatchery windows after emergence from the fish troughs, and as constituting a very considerable portion of the food of young sunfishes. It was abundant throughout July and August.

Tricorythus allectus. Since I described this species from Ithaca in 1905 [N. Y. State Mus. Bul. 86, p. 47] as Caenis allecta, I have concluded that it should more properly be referred to the genus Tricorythus.[1] Since that date I have found it abundant in two new localities, at Watertown, Massachusetts, in the summer of 1906, where spiders' webs on the bridges across the Charles river were draped with innumerable tangled specimens, and at Moose river, behind the hatchery at Old Forge. One of its favorite swarming places was the open area above the pole bridge shown in the middle of the photograph reproduced in plate 1. Here it swarmed at midday filling the air like snowflakes, with dragon flies, and robber flies lurking around the edges of the swarm, capturing as many specimens as they could eat.

Choroterpes basalis. This pretty red brown species I observed several times in small companies swarming about the balsam firs on Wintergreen point in August.

Habrophlebia vibrans n. sp. This delicate little reddish brown species I captured by hundreds near the outlet of Bald Mountain pond, where the brook crosses the road and begins its descent among the fern clad boulders. White winged companies of them were dancing up and down under the birch canopies, the lowest of them within reach of my net. I have been unable to determine from Bank's description and figure of H. americana [Ent. News. 1903, 11:235], what relation this species may bear to that one from New Jersey. The nymph of that one as described by Berry (*Amer. Nat.* 37:27–29, 1903) does not belong to this genus at all: it is a typical Leptophlebia. I present herewith a figure of the venation [pl. 10, fig. 1] and of the appendages of the male, and add the following further characterization of the male imago, the only form found:

[1] *See also* Cockerell & Gill. *Tricorythus, a genus of Mayflies.* Univ. of Col. Studies 3:135–37. A paper that has appeared since the above was written.

Length, 4.5 to 5 mm; setae about as long, or the middle one slightly longer. Foreleg, 6 mm; expanse of wings, 10 mm.

Color clear brown; paler beneath, with the eyes blackish inferiorly. Wings hyaline, except the extreme base, which is of an amber tint. Legs white except the forefemur which is brown, and a pale brown spot at the apex of the foretibia. Forseps beyond the base, and setae white, the latter with a few of the basal articulations narrowly annulate with brown. Abdomen transparent, whitish ventrally and to a less extent dorsally on the middle segments, the sides of the dorsum being tinged with brownish purple.

Many specimens, all males, taken swarming July 1, 1905.

Heptagenia pulchella. This species was common here, as at Saranac Inn, and my collection of it shows a number of dates running through July and August.

Heptagenia interpunctata. This species was taken by our trap lanterns from Moose river on the west side of the town, and a number of adults were taken from the hatchery walls.

Ephemera varia. Only a few specimens were seen, and these were taken by trap lantern from Moose river back of the town.

Potamanthus diaphanus n.sp. Under this name I describe an interesting species collected by Dr Betten at Squaw Island in the Niagara river near Buffalo on the 24th of July, 1906.

Length, 8–10 mm; expanse, 20 mm; setae of the male, 18–20 mm; fore leg, 13 mm; body and wings pale yellowish white, hardly darker on the top of the head and thorax but with a satiny sheen on the thorax and on tip of abdomen; tips of femora, tarsi and tibia very faintly infuscated, a subapical inferior spot on the foretibia being more distinct; setae, white, with the incisures scarcely darker; forceps white; eyes and ocelli, black; forceps of the male, regularly arcuate; basal segment twice as long as the two terminal ones together and rugose within: inner appendages united almost to the tip, half as long as forceps, with a W-shaped apical outline. The lateral margins are contracted in the middle and narrower, with parallel sides, in the basal half [*see* pl. 10, fig. 5].

Nymph. Measures 13 mm in length; setae 4 mm additional; antennae 1 mm long, their tips hardly surpassing the prongs of mandible, which unlike those of other species of the genus hitherto described, are longer than the head. Each prong is contracted just beyond the base and terminates in a straight, bare, brown point.

Body elongate; little depressed; prothorax wider than the head, with broadly rounded, flaring lateral margins; fore legs longer than the others; the tibia much longer than the femur, beset with long hairs internally, and bearing a stout, straight apical spur, almost half as long as the tarsus; middle legs shorter and more slender than the hind legs; abdomen regularly tapering posteriorly; gills rudimentary on the first segment, almost equal on segments 2 to 6,

deeply bifid, with the two divisions deeply fimbriate; setae, short, densely bearded, both sides of the middle portion bare at the ends, and paler toward the tips; there is a middorsal pale line along the abdomen and there are two rows of spots each side which sometimes become confluent.

Dr Betten's observations concerning the habits of this species are as follows:

Returning on the boat from Buffalo I happened to look up, and saw a swarm about 20 feet above the water. I was able to take a few, but most of them were out of reach from the upper deck. It was too dark for me to see the manner of their flight. I returned next evening for further observation, but a strong wind prevented. I found the cast skins, however, belonging to this species floating upon the water, and drifting upon the shore.

It is rather surprising that this interesting species, so common in a place much frequented by collectors, has escaped observation hitherto.

(?) **Choroterpes betteni** n. sp. Under this name I describe another May fly collected at Hamburg, N. Y., on the first of July by Dr Betten, in whose honor I name it. Its reference to this genus is a doubtful one.

Length, 5 to 6 mm; expanse, 10 to 11 mm; setae of the male, 5 to 6 mm and of the female 4½ to 5 mm; color nearly uniform, dark reddish brown, slightly paler on the middle abdominal segments in the male; wings hyaline; veins, pale brown; legs, yellowish brown; hind femur with two darker bands; forefemur of the male wholly dark; setae pale yellowish with brown joinings, three in number, equal; forceps of the male, pale brownish, darker beneath, with one very long basal, and two very short apical segments [*see* pl. 10, figs. 7 and 8].

The most remarkable thing about this species, a thing apparently quite unique among May flies, is that the female possesses a sort of rudimentary ovipositor. This is formed by a backward prolongation of the sternum of 7th segment combined with a downgrown horny process from the sternum of the 8th [pl. 10, fig. 6]. The sternum of the 9th segment is prolonged in two separate obtuse triangular lobes far beyond the apex of the 10th segment [pl. 10, fig. 6*a*].

Dragon flies at Old Forge

(*Odonata*)

As already remarked, the dragon fly fauna of Old Forge is less abundant than that of Saranac Inn. It possesses a number of interesting species, however.

Hagenius brevistylus. This big dragon fly was frequently to be seen on Moose river, by the hatchery, resting upon the pole bridge [shown on pl. 1] or upon boulders in the stream, or flying swiftly overhead in the pursuit of prey. Repeatedly I saw one sweep through the air, and capture another big species, an undetermined Gomphus, and fly with it struggling to the tree tops. A moment after it had alighted there, a gomphus wing would come floating down, and then three others, following.

Gomphus sp. (?) This is a species just noted as being captured by Hagenius. But, though Hagenius could capture it with apparent ease, I could not at all. I tried repeatedly, and stalked specimens with the utmost care as they rested on boulders in the edge of the stream, and once I came so near that I knocked a specimen into the water, but, notwithstanding all my efforts, I did not catch a single specimen, and so the species remains undetermined. It was a big olive-green species with the aspect of G. villosipes.

Gomphus spicatus. Cast skins of this species were sticking to the piers about Old Forge pond on June 20th, and a single live nymph was taken from the mud with the sieve net. Numerous species were seen along the road to Bald Mountain pond on the 2d of July.

Gomphus ventricosus. I was delighted to be able to capture at the road crossing Beaver Meadow brook the only specimen that I have ever seen alive. It was darting in and out among the shrubbery, apparently chasing midges, when I succeeded in landing it in my net. This was the first record of its occurrence within New York State. I searched diligently all about the brook for nymphs and for cast skins, but did not find any.

Dromogomphus spinosus. Several specimens of this handsome species were seen resting on the elder bushes by the road near Old Forge pond.

Cordulegaster sp. (?) Young nymphs were found in Bald Mountain pond on July 2d, and in Beaver Meadow brook on June 21st, but no adults belonging to this genus were observed during the season.

Aeschna sp. (?) Nymphs of Aeschna have already been noted as occurring in the food of bullheads and sunfish in Old Forge pond. They were quite common in Bald Mountain pond and in Lily pond, and about every pond near Old Forge adults could be seen coursing on swift strong wing all day long the summer through.

Anax junius. This species, so abundant through other parts of the State, is not common in the Adirondacks. Two nymphs were taken in Beaver Meadow brook on June 30th; no adults were seen.

Boyeria vinosa. A single young nymph of this species was taken in Moose river on the 9th of July. A few adults were seen later coursing over the stream.

Didymops transversa. Among the larger species coursing about the borders of Old Forge pond, this one was conspicuous. It was common through the latter part of June, and a number of cast skins were seen sticking to the bushes along the bank.

Helocordulia uhleri. This species frequented waters where the banks were fringed with sphagnum. It was seen in a few places up the channel from Old Forge pond, but not at the pond itself, and it was not uncommon at the Twin ponds and at Bald Mountain pond.

Tetragoneuria cynosura. This species was fairly common about Old Forge pond, where scattering cast skins could be found along the shore, but there was no abundance of it to be at all compared to the condition described at Saranac Inn in Bulletin 47 of this museum.

Cordulia shurtleffi. This handsome bronzy green species is another denizen of sphagnum bordered waters, and was common at Twin ponds and at Bald Mountain pond.

Libellula basalis. This species is rare in the Adirondacks, one or two specimens were seen, but not captured; nevertheless, there is no doubt about the determination.

Libellula pulchella. Common about every pond and commonly found foraging along the roadside at considerable distances from water.

Plathemis trimaculata. Another pond-loving species associated with the preceding.

Leucorhinia glacialis. This species was found only at the Lily pond, and only a few specimens were seen.

Leucorhinia frigida. This species was likewise found only at Lily pond, but it was common there, and moreover it was

transforming in some numbers. There I obtained specimens in transformation, furnishing me a new life history; the description of the nymph follows:

Length, 17mm; abdomen, 9 mm; hind femur, 5 mm; width of head, 5mm; of abdomen, 6 mm; body rather smooth, moderately depressed, greenish brown obscurely mottled above, paler beneath with a conspicuous banding on the under surface of the abdomen: there are three broad brown bands, one median, and two lateral (adjoining the ventral sutures), obsolescent anteriorly and more or less confluent posteriorly. Abdomen with no dorsal hooks at all (and therein differing markedly from all the other species of the genus hitherto made known)[1]; short, stout, straight lateral spines on segments 8 and 9; those of 9 longer than the segment, and twice as long as those of 8; inferior appendages with very slender tips slightly incurved. Superior appendage slightly shorter, and laterals one third as long as the inferiors; there is a fringe of slender hairs along the sides of the 9th segment, and across its apex beneath. The labium has 10 lateral setae, the two basal ones being smaller than the others, and 12 mental setae, the outer seven longer than the others.

Calopteryx maculata and C. aequabilis. A few specimens of both these species hovered about the mouths of the inflowing streams of Moose river below the hatchery. They were about equally common.

Lestes vigilax. This species was found associated with Leucorhinia frigida in the Lily pond, and like it, was transforming abundantly. From material obtained there on June 30th, and other material obtained at Bald Mountain pond on July 2d, the following description of the nymph is drawn:

The nymph is of the excessively elongate form characteristic of this genus and described for the group on page 231 of Bulletin 68. Length 26 mm and gills 10 mm additional. The color is greenish brown, there is an obscure band of brown on each femur and there are three such bands across the gill plates,

[1] In the key to nymphs of Libellulinae given on pages 508–9 of N. Y. State Museum Bulletin 47, Sympetrum and Leucorhinia are separated on characters found in relative length of dorsal abdominal hooks; and by the key this species would be traced to Sympetrum: at the time that key was prepared, only Sympetra were known to lack dorsal hooks. A new distinction will, therefore, have to be found between these genera. The species now known as nymphs may be separated by the number of raptorial setae on the lateral lobe of the labium; these are in the three species of Leucorhinia 10–11, in all our common lesser Sympetra they are 9; in the aberrant S. corruptum they are 13.

confluent along the gill axis. This species has five setae on each side of the mentum of the labium, and appears to be distinguished from the others hitherto described chiefly by the possession of a spine on the lateral margin of abdominal segment 3. The lateral spines in this species occur on segments 3 to 9: in the other species on segments 4 and 5 to 9.

The damsel flies of the following list were also collected sporadically during the summer and all of them were apparently common and widespread: Argia violacea, Enallagma exsulans, Enallagma hageni, Nehalennia irene, Ischnura verticalis.

Contribution to the morphology of the Odonata

Three years ago I suggested to Mr O. S. Thompson, who was then a student in my laboratory, that he investigate the homologies of the male abdominal appendages of the Odonata. There was then much confusion existing concerning the terminal appendages, and no extensive comparisons of those of the second segment had been attempted, the fragmentary studies of Ratzeburg, Ingenitzky and Goddard being in the nature of preliminary examination of a few forms. We have not known whether homologies are traceable through the two suborders. These parts being used more and more as a guide to relationships in the lesser groups, and as criteria of species, it seemed important that their nature should be better understood. Mr Thompson's work was done in 1904, but the final preparation of his paper has been delayed by various causes until the present time. Meanwhile, the terminal appendages have been carefully studied and fully reported upon by Drs Heymons and Handlirsch. The results of Mr Thompson's work upon the other abdominal appendages, those of the second segment, and adjacent thereto, are given at the end of this article.

CRANE FLIES

Family TIPULIDAE

Order DIPTERA

The crane flies constitute a large group of two winged flies that is of great interest to the student of the genetic relationships of the Diptera because of its rather generalized form

Fig. 5 Tipula abdominalis Say ♀ nat. size. (Reprint from N. Y. State Mus. Bul. 47)

and structure. It is of interest to the student of natural history also, because of the remarkable diversity of structure

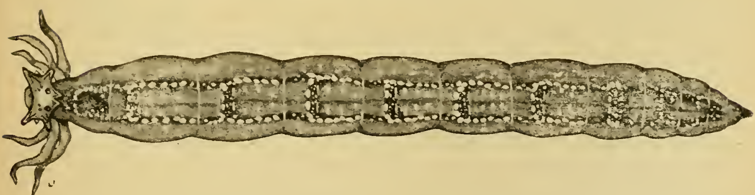


Fig. 6 Larva of Tipula abdominalis Say. (Reprint from N. Y. State Mus. Bul. 47)

and habits of the larvae. The group is largely represented within our borders, and during two past field seasons I have

been gathering specimens whenever I had opportunity, and studying life histories whenever other more insistent work would allow. In previous reports I have published more or less complete life histories of a number of crane flies with descriptions and figures of the immature stages. I wish to add at the present time the description of another larva, and of two new species, a preliminary list of the species of New York State, a key to our genera, and a study of the wing venation of the family.

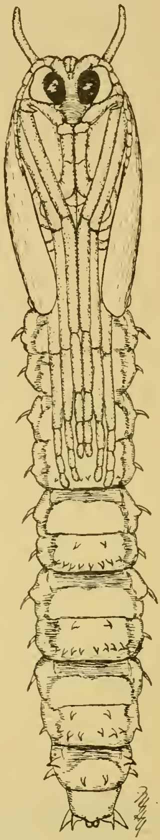


Fig. 7 Pupae of Tipula flavicans. (Reprint from N. Y. State Mus. Bul. 68)

Crane flies are doubtless familiar to everyone, although, perhaps, to some, under other names. Figure 5 illustrates the form of the more familiar species of the field and meadow. "Daddy longlegs" they are called by some, but this name is applied indiscriminately to almost any other long legged insect. "Gallinippers" is perhaps a local name, heard more commonly westward than within this State. Time was (and that recently too) when marvelous tales of the biting powers of bottom land mosquitos were proved by reference to the size of the "gallinippers" that could be pointed out in the infested districts; but that was before the recent awakening in the study of mosquitos had made everybody able to distinguish them from crane flies. The smaller crane flies are, indeed, mosquitolike in form, but easily distinguished by their structure. Certain adult crane flies are provided with a long beak but it is apparently not used for biting. None are harmful to man in the adult stage.

Economic importance. As larvae a considerable proportion of the group lives in the water; many live in wet soil and mud; some live in meadows and pastures; and a few live in wood. It is in the two last named groups that are found the species that are injurious to man's interests.

The larvae of the meadow inhabiting species are known as "leather jackets" or "meadow maggots." They burrow in the soil and destroy the roots of grasses, and when they

become abundant, they may be very destructive. The following are the more important papers dealing with the injurious species:

1892 **Webster, F. M.** Craneflies: Leather Jackets. O. Agr. Exp. Sta. Bul. 46, p. 238–47. (Fig. of egg, larva and pupa and adult Tipula bicornis and of adult Pachyrina sp. ?)

1893 ———————— Methods of Oviposition in Tipulidae. O. Agr. Exp. Sta. Tech. Ser. 1:151–54, pl. 1, fig. 4–7, pl. 2, fig. 1, 2

1896 **Hopkins, A. D. & Rumsey, W. E.** The Meadow Maggots. W. Va. Agr. Exp. Sta. Bul. 44, p. 258

1898 **Bruner, L.** Craneflies Attacking Clover. Neb. State Bd Agr. Rep't of Entomol. p. 256–57. (Discusses habits and remedies)

1899 **Ewert** Paper in Zeitschr. f. Pflanzenkrank. 9:328-2329. (Reviewed in Exp. Sta. Record, 11:1066)

1901 **Fuchs, F.** Ueber einige neue Forstschädliche Tipulidenarten. (Summary in Centralbl. Bakter. Abt. II. 6:573)

It appears from the foregoing American papers that the injury from crane fly larvae in meadows is easiest controlled by rotation of crops.

Figure 6 is the larvae of a mud inhabiting species; those that dwell in moist soil are, as a rule, similar in form, with less of color pattern and with much shorter appendages about

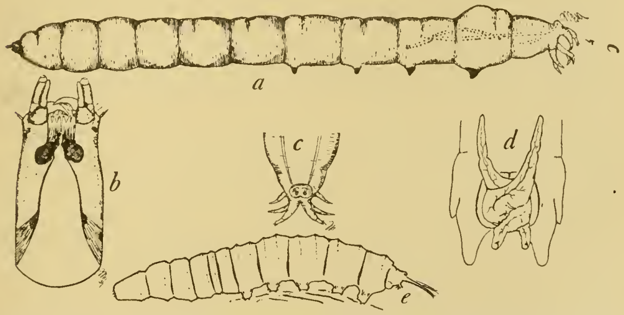


Fig. 8 Crane fly larvae: *a* larva of Pedicia albivitta; *b* head from below; *c* caudal end from above of the same; *d* ventral view of end of abdomen of larva of Epiphragma fascipennis, showing protruded rectal gills; *e* larva of Raphidolabis tenuipes

the end of the body. The pupae [fig. 7] are formed in the end of the larval burrow, the head end usually projecting upward near the surface of the soil. On plates 31 and 32 are shown the stages of development in a species that lives under the wet bark of trees and rotting logs [repeated from N. Y. State

Mus. Bul. 68, where first published], and figure 8*a* herewith shows the form and structure of the larva of a species that lives in the water of spring brooks [also copied from the above mentioned bulletin].

Crane flies are much neglected by collectors of insects, for at best they do not make a very attractive collection, and good specimens are obtained only with more than the usual care that is bestowed upon them. At their worst they are an unsightly assortment of mostly legless fragments. Their legs break off very easily, and rough handling will surely lose them. But if specimens are taken in a net with reasonable care, killed in a cyanide bottle without handling, and *pinned soon after killing,* there will be little difficulty in getting specimens with six legs. It will not do to leave them lying around in the cyanide bottle; for the legs soon become detachable with the slightest touch. If specimens are to be spread, the spreading should be done on a flat board drilled with small holes, and the flies spread in inverted position with the pin heads stuck down the holes.[1] Thus placed, both wings and legs are easily arranged in any position desired.

My own collecting of crane flies has been done chiefly about water and with the aid of a trap lantern. I have obtained thus mainly the smaller and less conspicuous species, nearly all of which belong to the subfamily Limnobiinae. I have found few new species, and of these I have described only those I wished to refer to by name in the venation study which follows. I have been on the lookout especially for such as would show new venational peculiarities or variations.

The fewness of the new forms encountered is evidence of the thoroughness of the collecting done by Baron Osten Sacken on his visits to West Point, Saratoga and Trenton Falls, while he was in the diplomatic service at Washington. Trenton Falls especially yielded him a large number of new species. Old Forge lies near Trenton Falls, and furnishes kindred habitats, and I was much pleased while collecting there to be able to pick up most of Osten Sacken's species.

In the following list are included the names of 104 species of crane flies nearly all of which have now been recorded from the State. The list is of course very incomplete, and it is hoped

[1] See my article, "A Simplified Spreading Board" in Psyche. 1902. 9:427–28.

that the key and the figures will facilitate the collection and identification of much new material in this neglected group.

I have found the material accumulated in the course of the station work of the past two seasons sufficient in amount and variety, and in the range of forms brought together to serve for the basis of a study I have long wished to make of the venation of the crane flies. These are generally recognized as being among the most primitive of the Diptera, and among the more generalized of the families that seemed likely, on account of the great number of their members and consequent variety of interrelated forms, to offer materials for the solution of some pressing problems in taxonomy. That among the Tipulidae might be found the key to the solution of some of the remaining problems of venation has seemed altogether probable.

Preliminary list of New York crane flies

The following list is based on the collections accumulated during the course of the summers of 1905 and 1907 (mainly by trap lantern), the published records (chiefly taken from Aldrich's Catalogue of North America Diptera) and data available in the Cornell University collection. For the convenience of the user, I follow the order of arrangement of the above mentioned catalogue, although, as stated elsewhere I believe the natural order of arrangement of the group is therein frequently inverted.

1 Geranomyia canadensis Westw. A few specimens were taken in trap lanterns at Old Forge during August. Specimens from Manlius, N. Y. August 20, and from Ithaca (July 14-16) are in the Cornell University collection. This species hovers about wet timbers on the edge of streams or on wave beaten shores.

2 Rhipidia fidelis O. S. This species was described by Osten Sacken from specimens obtained from Sharon Springs, N. Y. I have not seen it.

3 Rhipidia maculata Meigen. This pretty species I encountered at Old Forge in two very different situations. A little company of males I observed hovering about the trunk of a tall beech tree in the yard of the cottage in which I lived (Camp Sakheywey). The trunk was partially moss covered, and stood on the edge of the forest, and just before

nightfall on several evenings in succession I saw a group of six or eight males of this species spinning slowly around the trunk in zigzag course, rising and falling, but never departing more than a few inches from the bark, nor rising as high as the spreading branches above. By climbing a pole that leaned against the trunk, and swinging a net above me I was able to capture a few specimens. The other situation in which I found this species was in my water tent trap [*see* preceding chapter]. Here were both males and females, doubtless recently emerged from the bed of the brook; or, possibly from the scanty layer of moss that was exposed on some of the stones in the brook. This is a very different habitat from that reported from the European species of the genus — excrement, or decaying matter [Wahlgren. Ent. Tidskr.].

4 Discobola argus Say. Several times reported from the State, hitherto, but not encountered by me.

5 Dicranomyia badia Walk. I collected this species sparingly at "The Glen" Ithaca in May, and there are specimens in the Cornell University collection dated in June.

6 Dicranomyia brevivena O. S. Recorded by Osten Sacken from New York.

7 Dicranomyia haeretica O. S. Taken at Old Forge in August.

8 Dicranomyia immodesta O. S. Taken by me at Old Forge in August 1905, and by Dr Betten in August 1906, at Niagara Falls.

9 Dicranomyia liberta O. S. Reported by Osten Sacken from New York.

10 Dicranomyia longipennis O. S. Reported by Osten Sacken from New York.

11 Dicranomyia moniliformis Doane. Described by Doane from Long Island.

12 Dicranomyia morioides O. S. Reported by Osten Sacken from Trenton Falls. I observed males at "The Glen" Ithaca about the middle of June 1907, swarming in vast companies, over an open roadway and in the hollow of a hillside meadow.

13 Dicranomyia pubipennis O. S.
14 Dicranomyia rara O. S.
15 Dicranomyia rostrifera O. S.
} Reported by Osten Sacken from New York.

16 Dicranomyia simulans Walk. A full account of the life history and habits of this widespread species is given on pages following.

17 Dicranomyia pudica O. S. June, Ithaca, N. Y. Cornell University collection.

18 Dicranomyia stulta O. S. Reported by Osten Sacken from Trenton Falls, N. Y.

19 Limnobia cinctipes Say. A few specimens of this widespread and handsome species came to trap lanterns at Old Forge in August 1905.

20 Limnobia immatura O. S. Regional, but apparently not yet reported from the State.

21 Limnobia indigena O. S. Taken at Old Forge in August. "The Glen" Ithaca on June 4th, and specimens are in the Cornell University collection from Manlius, N. Y. dated September 1, 1872. Apparently it is of wide seasonal range.

22 Limnobia parietina O. S. Described from Trenton Falls, N. Y.

23 Limnobia solitaria O. S. Reported by Osten Sacken from the State.

24 Limnobia triocellata O. S. Described from Trenton Falls. In the Cornell University collection from Manlius, N. Y., September 1, 1872.

25 Toxorhina muliebris O. S. Reported by Osten Sacken from the State.

26 Rhamphidia flavipes Macq. I captured specimens of this species flying singly about the marsh near the Cornell University Biological Field Station about the first of June 1907. They flew from stem to stem, with considerable speed, but with little persistence of flight.

27 Elephantomyia westwoodi O. S. A few specimens came to trap lanterns set over Moose river at Old Forge in August 1905.

28 Atarba picticornis O. S. I have a specimen that has lost its label, that came, I think, from Old Forge, it was reported from Trenton Falls by Osten Sacken.

29 Dicranoptycha germana O. S. Obtained in trap lanterns at Old Forge in July and August.

30 Teucholabis complexa O. S. Reported by Osten Sacken from Trenton Falls.

31 Antocha opalizans O. S. Obtained in my tent trap in Beaver Meadow brook in extraordinary abundance, as detailed elsewhere in this report.

32 Cladura indivisa O. S. Reported by Osten Sacken from Trenton Falls.

33 Cryptolabis paradoxa O. S. Two male specimens in the Cornell University collection were taken at Enfield Falls, N. Y. on July 12, 1891.

34 Rhypholophus holotrichus O. S. Ithaca, N. Y., May 20, 1891.

35 Rhypholophus innocens O. S. "The Glen" Ithaca, May 22, 1907.

36 Rhypholophus monticola O. S. Taken commonly at Old Forge in trap lanterns in August.

37 Rhypholophus meigenii O. S. "The Glen" Ithaca, May 30, 1907.

38 Rhypholophus nigripilus O. S. "The Glen" Ithaca, May 22, 1907.

39 Rhypholophus nubilus O. S. "The Glen" Ithaca, May 22, 1907.

40[1] Rhypholophus rubellus O. S. Reported by Osten Sacken from West Point, N. Y. Specimens in the Cornell University collection were taken at Ithaca, May 20, 1891.

41 Erioptera (Hoplobasis) armata O. S. Reported by Osten Sacken from the State. I have observed this species swarming in a ravine in the Biological Garden at Lake Forest in Illinois. At a very low elevation in an open pathway that was overarched by shrubs, companies of a few score were dancing up and down, or, when disturbed, scattering with irregular zigzag flight. Among several hundred specimens captured with a net from these swarms, all were males save three.

42 Erioptera armillaris O. S. Described from Trenton Falls.

43 Erioptera (Mesocyphona) caloptera Say. This widely distributed species I have taken in trap lanterns wherever I have run them, but always sparingly. A few adults can usually be swept from vegetation in wet swales.

44 Erioptera chlorophylla O. S. This crane fly, unique in its pale green color, may often be obtained in very great numbers in trap lanterns that are set over beds of submerged vegetation in still water. The lantern that was set at the hatchery pier in Old Forge pond attracted considerable

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[1] 40^a R. arcuatus Doane and 40^b R. parallelus Doane from Ithaca have been described since the above list was prepared (Ent. News. 19:201–2).

numbers, but not such excess as came to my lanterns when set in shallow lakes in the Middle-Western States. Its larva — probably strictly aquatic — has not yet been found.

45 Erioptera chrysocoma O. S. Regional, but not yet reported from the State.

46 Erioptera septemtrionalis O. S. Obtained from trap lanterns set on Moose river at Old Forge in August 1905.

47 Erioptera (Acyphona) venusta O. S. Rarely taken in trap lanterns. Occasional specimens, stretched out against the walls like grass spiders, could frequently be found on the Old Forge hatchery. This species frequents the fallen leaves in the woods, and against the brown background of this leaf cover, it is well nigh invisible.

48 Erioptera vespertina O. S. 49 Erioptera villosa O. S.	Both these species are regional, but unreported from the State.

50 Molophilus hirtipennis O. S. Taken in trap lanterns at Old Forge sparingly during July and August. "The Glen" Ithaca June 17, 1907.

51 Molophilus pubipennis O. S. Taken in trap lanterns at Old Forge in August.

52 Gonomyia blanda O. S. 53 Gonomyia subcinerea O. S. 54 Gonomyia sulphurella O. S.	Reported by Osten Sacken from the State, the last two from Trenton Falls.

55 Empeda stigmatica O. S. Described by Osten Sacken from Trenton Falls.

56 Helobia punctipennis Meig. A wide ranging species, that comes sparingly to trap lanterns. It appears on the wing in the Renwick marshes at Ithaca before the frost is all out of the ground in March.

57 Chionea valga Harris. An early winter species of wingless crane fly, best known for its habit of appearing on snow. Specimens in the Cornell University collection are from Manlius, N. Y., October 1, 1872, and from Ithaca November 15, 1892 and March 15, 1896. Dr Riley collected a number of specimens at Forest Home in December 1907, and a single specimen of another apparently undescribed species, with spinous middle femora.

58 Trimicra anomala O. S. Reported by Osten Sacken from the State.

59 Gnophomyia tristissima O. S. Norton's Landing, N. Y., June 19, 1872, in Cornell University collection.

60 Ulomorpha pilosella O. S. Described from Trenton Falls. Taken in trap lanterns at Old Forge once or twice in July.

61 Trichocera brumalis Fitch. This species appears on the wing in late autumn and early spring, and on warm days in winter. It is seen not infrequently flying over the snow.

62 Limnophila (Dicranophragma) fuscovaria O. S. In the Cornell University collection from Norton's Landing, N. Y.

63 Limnophila macrocera Say. Axton, N. Y. June 1901 (MacGillivray).

64 Limnophila (Dactylolabis) montana O. S. A specimen was sent me by Mr Charles P. Alexander, taken on the 16th of May at Gloversville, N. Y.

65 Limnophila niveitarsis O. S. Several female specimens were taken in trap lanterns at Old Forge, July 20th.

66 Limnophila (Prionolabis) rufibasis O. S. Norton's Landing, N. Y., June 2, 1872, in Cornell University collection.

67 Limnophila tenuipes Say. Manlius, N. Y., September 6, 1872, Cornell University collection.

68 Limnophila toxoneura O. S.
69 Limnophila brevifurca O. S.
} Taken commonly at Old Forge in August.

70 Limnophila adusta O. S. Manlius, N. Y., September 6, 1872, Cornell University collection.

71 Epiphragma fascipennis Say. Ithaca, May 8, 1891.

72 Eriocera longicornis Walk. Ithaca, May 2, in Cornell University collection.

73 Eriocera spinosa O. S. Recorded by Osten Sacken from Trenton Falls.

74 Penthoptera albitarsis O. S. Ithaca, N. Y., July 14, 1892, a single male in the Cornell University collection. "The Glen" Ithaca, September 17, 1907; a single female specimen that I captured in my hat while it hovered with its long, white feet outspread over the surface of the water in a spring basin.

75 Rhaphidolabis tenuipes O. S. This species appeared in surprising abundance in my tent trap set in Beaver Meadow brook at Old Forge. In a spring brook at "The Glen" Ithaca, I have found it likewise abundant. The larva is described at the conclusion of this list.

76 Ula elegans O. S. "The Glen" Ithaca, May 25, 1907; at trap lanterns, rarely, in August at Old Forge.

77 Amalopis calcar O. S. At trap lanterns, August 1905, Old Forge.

78 Amalopis inconstans O. S. Manlius, N. Y., September 10, 1872. Old Forge, during July and August. Not infrequently resting spiderlike on the outside of the hatchery building at Old Forge, and easily picked by hand.

79 Pedicia albivitta Walk. Specimens labeled Baldwinsville, N. Y., September, and Manlius, N. Y., September 10, 1872 are in the Cornell University collection. The figures of the immature stages of this species described by me in bulletin 68 of the N. Y. State Museum are republished herewith [fig. 18 *a, b, c*].

80 Liogma nodicornis O. S. A single pair of this species was taken while sweeping by the spring at the "Old fish ponds" at Old Forge. They were clinging to the grasses at the edge of the spring brook.

81 Phalacrocera tipulina O. S. Of this interesting species I have seen only a single wing [pl. 3, fig. 6: it is ample for identification]. I found it in the leaf of a pitcher plant (Sarracenia) in a little upland sphagnum bog between Little Moose mountain and the Old Forge pond while accompanying Dr Felt on a collecting trip for bog mosquitos August 3, 1905. The "pitcher" contained besides this wing:

8 wings of an undetermined species of Dicranomyia
4 wings of an undetermined species of Rhamphomyia
4 wings of some member of Anthomyiidae
4 wings of some member of the Muscidae
1 wing of a Ceratopogon
1 wing of a Leptomorphus
4 wings of undetermined species of Sciophila
2 wings of undetermined species of Psilocephala
4 wings of an undetermined caddis fly, probably Limnophila
The remains of a big longicorn beetle, and
4 living and normal orthoraphous fly larvae, healthy and well fed citizens of the place. The miscellaneous Diptera of the above list were kindly determined for me by Dr O. A. Johannsen.

82 Idioplasta fitchi O. S. This singular and primitive crane fly was originally discovered in New York State, but seems not to have been taken there again. I have not seen living specimens.

83 Bittacomorpha clavipes Fabr. Saranac Inn, Old Forge, Ithaca, common in the red rotten debris that lies half floating at the edge of the water in sequestered places in swales and at the head of ponds. Its singular larva and pupa are well known through the description and figures published by Mr Hart [Ill. State Lab. Nat. Hist. Bul. 4:190–95, pl. 6].

84 Ptychoptera rufocincta O. S. West Danby, N. Y., first week in June 1905.

85 Dolichopeza americana n. sp. Old Forge in August. Description follows at the end of this list.

86 Oropeza annulata Say. Old Forge, N. Y., and Ithaca, N. Y., in August.

87 Xiphura frontalis O. S. Ithaca, N. Y., May 31, Cornell University collection.

88 Xiphura fumipennis O. S. Ithaca, N. Y., May 31, Cornell University collection.

89 Xiphura topazina O. S. Ithaca, N. Y., May 31, Cornell University collection.

90 Pachyrhina incurva Loew. Manlius, N. Y., August 24, 1872.

91 Pachyrhina lugens Loew. Norton's Landing, N. Y., June 2, 1872.

92 Pachyrhina unifasciata Loew. Norton's Landing, N. Y., August 12, 1872.

93 Pachyrhina unimaculata Loew. Norton's Landing, N. Y., September 6, 1872.

To the following records of occurrence of Tipulinae in the State I have nothing to add. The species are represented in the Cornell University.

94 Pachyrhina ferruginea Fabr.

95 Pachyrhina gracilicornis Loew.

96 Pachyrhina pedunculata Loew.

97 Pachyrhina tenuis Loew.

98 Tipula abdominalis Say. Saranac Inn, Ithaca

99 Tipula apicalis Loew.

100 Tipula bella Loew.

101 Tipula fasciata Loew.

102 Tipula grata Loew. Sharon Springs
103 Tipula infuscata Loew.
104 Tipula strepens Loew. Axton

New genus and two new species of Tipulidae

In the course of my collecting of Tipulidae I have taken a number of forms that appear to be new to science, but most of these are species that show no venational peculiarities, and need not be considered here. Finding it necessary to refer to the others by name, I give herewith brief diagnoses of them.

Oropeza n. gen. Radial sector apparently two branched, its base very short, originating opposite the tip of the subcosta; median vein three branched, with a median cross vein closing a very narrow discal cell that is situated almost entirely beyond the inner line of cross veins, and vein M_3 is bent upward upon this cross vein. Legs excessively long, femur and tibia of equal length, and the first tarsal segment as long as both together; each tarsal segment as long as all the segments beyond it taken together. Paired valves of ovipositor of the female of very unequal length.

Type Tipula annulata Say. This species has been doubtfully referred to Dolichopeza hitherto. In venation it differs markedly in the relation the deflection of Cu_1 bears to the first fork of the median vein, and in the retention of a median cross vein, and in some minor matters such as the relatively longer base of its radial sector. These differences may be seen by comparing figures 3 and 5 of plate 16.

Dolichopeza americana n. sp. Osten Sacken has reported the occurrence of undescribed species of this genus in America, and one of them I found at Old Forge in August 1905. That it is a true Dolichopeza will be seen by reference to the venation of its wing as shown in plate 16, figure 5.

Its expanse of wing is 21 mm. Its color is brownish, paler ventrally. Its antennae are of moderate length, with the brown flagellum consisting of 10 segments, slowly diminishing in length toward the tip and beset with a few stout, black hairs. The wings are of pale brown, with venation as shown in the figure just cited, the halteres are infuscated at tips. The legs are of the usual excessive length; femora and tibiae are brown, with white bases, and all the tarsus is white except the basal half of the first segment and the apical half of the fifth segment.

? **Dicranomyia whartoni** n. sp. Expanse of wings 9.5 mm.

Color yellowish, darker on the dorsum, and on the forelegs. Wings hyaline with brownish veins, the color being deepest along the radial and cubital stems. Middle and hind legs yellow, forelegs brownish, all legs darker on tips of tarsi. The head is yellow but the three terminal segments of the palpi are brown, and the flagellum of the antenna is brownish; it consists of 12 oval segments, the last one seated styluslike on the apex of the one before it and not fully differentiated therefrom, the flagellum hardly longer than the total length of the head including its short proboscis. The lower valves of the ovipositor are broad and obtuse at the apex; the upper valves are short, triangular at base, but prolonged and upcurved at apex; and the tips of the two pairs are nearly on a level.

A single female specimen was obtained at Walnut, Lake Michigan on the 7th of August 1906 in a trap lantern. It will probably eventually constitute a new genus, but it is evidently derived from the more typical Dicranomyia, by a process of reduction, and it represents the maximum of reduction of the median vein along this developmental line.

I take pleasure in dedicating this species to my former pupil, Mr C. O. Wharton, to whom I am indebted for the preparation of the pencil drawings for most of the original figures of this paper, and for some other assistance toward its preparation.

I wish to call attention in passing, to a number of forms in this family that are misplaced. Meunier's fossil crane fly from amber Palaeoerioptera [Ent. Soc. France. Bul. 68:359, fig.] is not a Tipulid at all but belongs to the Psychodidae.

Van der Wulp's Tipula tenuis [Tijd. v. Ent. 1884, 28:85, pl. 4, fig. 7. I have copied the figure in pl. 16, fig. 2] is not a Tipula at all. In its long m-cu cross vein, situate at the very inner end of the cell, 1st M_2, it is much more like Megistocera [*see* pl. 16, fig. 4] but it probably represents a new genus.

If the two figures I have copied on plate 18, figures 5 and 6 are at all accurate, Libnotes must be polymorphic. The last figure is probably incorrect in its representation of the wing veins near the costal border of the wing.

Larva of Rhaphidolabis tenuipes O. S.

In Beaver Meadow brook, just before the door of the water tent described in preceding pages, I collected from among the round

stones of the bottom, a few larvae of this species. They were not reared, but the abundance of adults issuing in the tent, and the great likeness of the larva to that of the closely allied genus Dicranota, as described and figured by Miall,[1] leave scarcely a possible doubt as to its identity.

The larva [fig. 19*e*] measures in length 8–9 mm, with the caudal processes 1 mm additional. Diameter 1 mm. The body is cylindric and tapers forward on the thoracic segments, which while decreasing in diameter increase in length, the first segment, within which the head is wholly retracted, being twice the length of the third. At the base of the first segment is a narrow interpolated ring, which, in Dicranota Miall interpreted as a posterior division of the basal abdominal segment. So interpreted, the abdomen consists of 9 segments of which the first two and the last one are legless, while the intervening five segments bear prolegs. These prolegs are fleshy, retractile, unpaired and widely separated on the mid ventral line, and each bears a circlet of outcurved hooklets at its tip, and diminishing series of lesser hooklets, graduating into the scurfy pubescence of the general integument, back from the tip.

The skin is of a dirty whitish or yellowish white color, and its appressed pubescence is roached up into two tranverse lines on each of the leg-bearing segments (which thus, and by reason of a slight constriction between these ridges of pubescence, is made to appear double) and into single lines on the other segments. The abdomen tapers abruptly upon the eighth segment to the end and bears at its tip two long, fleshy filaments that are obtusely pointed and bear a few short, terminal hairs. Above the bases of these filaments is the imperfectly developed respiratory disk. The two bare spiracles are surrounded by roundly curved, raised lines of pubescence, and separated by a median groove, upon which, as a hinge line, apparently they may be folded up together. I take it that these spiracles are exposed in air, and closed together in water, and that four anal tracheal gills that may be seen projecting by their tips from the anus, are then protruded for aquatic respiration. This is a common arrangement for amphibious life in crane fly larvae. However, I merely collected these, and did not study their habits.

[1] Miall, L. C.

The head when dissected out of the prothorax shows a median blackish line, dilated behind where it joins at the rear of the head, and shorter, blackish, paired stripes that lie upon the hind angles externally. The length of the head is three times its width. The blackish mandibles are armed internally with about five teeth among which are two longer ones that alternate with three shorter ones. The maxillae are shorter than the mandibles, and each bears a bunch of fleshy processes upon its tip.

Life history of Dicranomyia simulans Walk

This common and widespread species is found about wet logs on the edges of streams, and on wave beaten shores. I had an excellent opportunity for observing its life history and habits at Lake Forest, Ill., during several weeks of the latter part of the summer of 1906. It is abundant on the piers along the west shore of Lake Michigan, and the "Ferry Hall Pier" at Lake Forest was conveniently near the cottage in which I was living. This pier was built on heavy driven piling, covered outside with heavy plank. About three feet of surface was exposed above the water at its normal stage. The planks were old, and sheltered a scanty growth of short, stemmed mosses in the cracks, and bore a heavy fringe of Cladophora and other algae just below the water line, with a film of "skin algae" extending a little higher.

All over the sides of the plank, in either sun or shade, the adult simulans could be seen throughout the summer months, sometimes in considerable numbers. I was first attracted to notice them by their habit of running rapidly sidewise along the pier, and their resemblance to harvestmen (Phalangidae). They run habitually sidewise, apparently rarely moving forward except to escape an obstruction, and very rarely appearing on the top of the pier. They rest in an inverted position on the under surface of the overhanging plank on the top of the pier. They stick to the surface so persistently that it is difficult to make one take flight; they may be driven all about on the surface, or poked with a stick; they can fly well enough when they will, but when induced to fly they settle again almost at once, and within a few feet of their starting place.

They are associated upon the piers with Geranomyia canadensis and with numerous midges and micro-caddis

flies (Hydroptilidae) and a few larger caddis flies of the genus Hydropsyche.

Males are more in evidence, but probably not more abundant in fact. The females come out from their resting places only to lay their eggs, and are only to be seen when busily engaged in the performance of this task. They stand on tiptoe, with the long ovipositor held in vertical position at the tip of the deflexed abdomen, and they swing the body up and down in rapid shuttlelike vibration, freely rising and falling on the long and widely outspread legs. Thus the point of the ovipositor is driven against the wet surface of the plank, thrusting almost as rapidly as the needlebar of a sewing machine: it is moved about over the surface, as if searching for soft spots in the wood, and occasionally it makes a deeper thrust when a suitable place is found, and an egg is deposited.

The egg-laying process is often interrupted and is continually interfered with by the too importunate males. When a male in running about on the plank comes upon a female ovipositing, he stands directly above her at the full upward stretch of his legs, while she goes right along with her work; but the instant she ceases her vibrating and lifts her ovipositor, he is ready with his forceps, upturned and outspread at the tip of his decurved abdomen, to seize her. Usually she does not want to be interrupted and moves away, while he tries to run parallel and maintain all the while his position of vantage above her. Often other males are encountered, and then the males engage in a rough and tumble fight. They push and shove each other in a most ludicrous manner, reminding one of pigs fighting, and often an encounter of this sort enables the female to escape and to go on quietly with her work.

The males have well developed eyes, but their sight must be very poor; for, while always searching for females, they seem quite unable to find them by sight, often passing females at work within a distance of a few centimeters. But their tactile sense seems more acute. When a male in running to and fro had passed several times within 6 centimeters of a female without noticing her, was deflected from his course toward her by an obstruction I purposely placed in his way, he instantly sprang toward her upon the slightest contact, even of tips of tarsi, but was quite unheeding until this contact occurred. If it did not occur he would pass on, even by the narrowest margin.

All stages are found together on the piers. The eggs are laid in the soft spots in the old wood, where the surface of the pier is kept wet, but not continually covered by water, in the zone of the "skin algae." The larvae live exposed or thinly algae covered, and crawl about slowly over the wet surface. They are greenish in color and very inconspicuous. In a cavity among the stems of the dwarf mosses[1] in a crevice at the upper limit of the wet area the larva spins about itself a sheet of tissue and fastens bits of moss stems and leaves to its outside, [fig. 9] and transforms inside the tube thus formed into a pupa. The tube is longer than its body, and the pupa moves in or out at will, doubtless by the aid of the hooks at the ends of its body.

The larva measures in total length 10 to 15 mm, according to the state of extension of its body, and its diameter is, correspondingly 1.5 to 2 mm. It is cylindric, abruptly tapering posteriorly on the last abdominal segment. The head is wholly retracted within the swollen prothorax: extracted therefrom, the head shows a broad middle pale yellow band, and its sides are black from the base of the antennae backward. The labrum is transversely oval, with a margin of close set scurfy hairs. The clypeus is one fourth broader than the labrum, yellow with parallel sides, but emarginate on the front for the reception of the labrum, there are three recurved stout setae on the lateral margins of the clypeus each side, and one on each angle and two upon its disk.

Fig. 9

There are no legs, but there is a scurfy pubescent creeping fold on the under surface of the meso- and metathorax and a similar one on the first abdominal segment: and there are much larger, transversely placed, muscular, scurfy-skinned creeping ridges on the under surface of abdominal segments 2-7 toward the front of

[1] These mosses were kindly named for me by Professor Barnes of Chicago University, as *Bryum binum* Schoeb. var. *varium* Lindb. and *Amblystegium orthocladon* Lesq. and James.

each segment; and on these same abdominal segments on the dorsum, but not extending down on the sides, there are transverse bands of scurfiness differentiated from the general pubescence, in corresponding positions. The dorsum is covered with close set pubescence, greenish brown in color with an interrupted middorsal row of alternating paler dots and cross marks.

The respiratory disk of the larva [fig. 10] is channelled on the median line, with sloping sides that fold together when under water. Its border is fringed with short hairs, and is destitute of fleshy tubercles. The spiracles are oval. Four retractile fleshy anal gills are protruded for respiration under water, when the disk is closed.

The pupa, withdrawn from its tube [fig. 9] is smooth and shining, pale brownish on ends, and measures 8 mm in length and 1.5 mm in diameter. The front of the thorax is upcurved dorsally. The respiratory processes of the prothorax are broad, laterally flattened, obtuse at apex and each bears a basal recurved sharp hook on its dorsal side. The numerous minute divisions of the spiracular orifice are arranged in a semicircular row along the obtuse tip of the process. The dorsum of the thorax shows a faint fretwork of raised lines on its surface. The abdomen is smooth, but bears transverse lines of scurfy pubescence in positions corresponding to those already described for the larvae. The abdomen terminates in a pair of stout, sharp recurved hooks.

Fig. 10

In all the pupae found except a few of the oldest, that were nearly ready for transformation, there were chitin tubes protruding from the spiracles of the middle abdominal segments. These were the linings of the larval tracheae, not wholly withdrawn from the spiracles. It is possible that these may serve a respiratory function for a pupa provided otherwise with only aerial respiratory apparatus yet living within the reach of the higher waves: that is to say, they may possibly act as do the tube gills of the Simulium pupa, obtaining oxygen from the water flowing over them. In that case both larva and pupa would be amphibious in respiratory habits.

Venation of the wings of Tipulidae

The framework of the wing of a crane fly consists of six, seven or eight longitudinal veins, that are joined together at base and apex by a few cross veins. These principal veins are free in their middle

course and are generally clearly recognizable. They will be designated in this paper by the following names and abbreviations for them:

Costa (*C*)
Subcosta (*Sc*)
Radius (*R*)
Media (*M*)
Cubitus (*Cu*)
Anal veins (*1st A, 2d A, 3d A*)

On the accompanying diagram [fig. 11] of a crane fly wing these principal veins are designated at the base by the abbreviations given above. It will be observed that the radius is distinguished by the possession of a very large and conspicuous posterior branch. This branch is called the radial sector (*Rs*). All other branches are

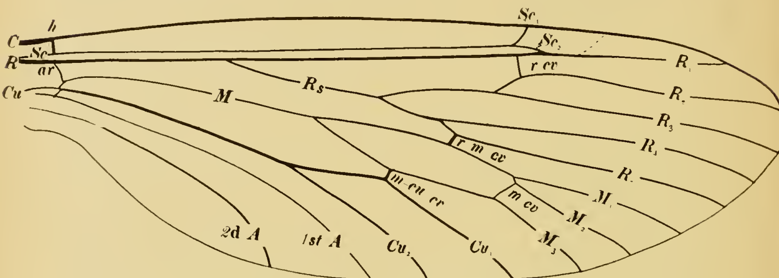

Fig. 11

designated by number, the numbers beginning at the front and continuing posteriorly, the number being added to the symbol for the vein, for any branch to which it belongs. For example the branches of the radial vein are labeled R^1, R^2, R^3, R^4, and R^5. The costa is simple and lies on the foreborder of the wing. The subcosta is two branched and bears a short apical fork, but the divisions of this fork, running as they do into costa and radius respectively, have usually the appearance of cross veins. The radius gives off its sector as already noted, and this in turn is dichotomously twice forked. Media likewise has a manner of forking essentially like that of the radial sector, and cubitus is once forked. Although the anal veins are usually simple, the second of them is occasionally forked at the tip.

It may be observed in any wing that costa, subcosta and radius run closely parallel along the front margin of the wing and that the subcosta lies in a deep groove between the other two, and is usually strongly braced against them. Thus, both by approximation of these strong veins and by the corrugation of the membrane, the front of the wing is made rigid. The other posterior veins extend wide apart diagonally across the outspread membrane of the wing disk.

The cross veins of a crane fly wing are rarely more numerous, usually less numerous than are the longitudinal veins. A humeral cross vein (*h*) strongly joins the costal and subcostal veins near the base. The other cross veins of the wing that are considered typical for the Tipulidae lie in the distal part of the wing and may be conveniently designated by the names suggested by their positions, as follows: the radial cross vein (*r*), the radio-medial cross vein (*r-m*), the median cross vein (*m*), and the medio-cubital cross vein (*m-cu*), small letters being used as symbols to avoid confusion.

This system of venation is characteristic not only of all Tipulidae, but also of all Diptera, and of a number of other orders of insects as well. In so far as the trunks of the principal veins are concerned, it is characteristic of all winged insects.

Toward the working out of the system of the venation of the Diptera, systematic dipterologists have contributed surprisingly little, and toward the correlation of it with that of other orders, they have done nothing at all. Redtenbacher laid the foundations, and Comstock built thereon, and by comparative study established the system on a firm basis and published it in his *Manual for the Study of Insects.* He once told me that it was in the study of the venation of the Diptera that he first felt the solid ground of true homologies beneath his feet. I have had hitherto no share in the brilliant work that has been done on the venation of this order. The chapters on Diptera, Hymenoptera and Lepidoptera of the *Wings of Insects* were wholly the work of Professor Comstock. After this work was done I joined him in a search for ontogenetic confirmation of homologies already determined; but in the order Diptera, that search proved wholly fruitless. The proof of homologies in dipterous venation rests on comparative anatomy alone.

When Professor Comstock and I published jointly the *Wings of Insects,* we endeavored to construct a wing that should be typical for all the orders. Afterward, studying the venation of the

Odonata,[1] I came to the conclusion that our hypothetical type wing did not represent all the venation of the primitive insect wing, but only the main skeleton of it. That the longitudinal veins of that type were possessed by the primitive insect I do not doubt: they represent the main lines of chitin deposition along primeval tracheae; but the interspaces between these veins were occupied, I believe, by a more or less irregular meshwork of cross veins, which disappear with the progressive differentiation between strong veins and thin membrane. Redundant cross veins are still characteristic of many generalized insects, and were so of most of the older fossils known. I have given in the paper just cited [p. 725–28] a theory as to the mode of differentiation of strong cross veins in the dragon flies. There is much less evidence as to how the reduction may have occurred in the Diptera; but I have no doubt that the supernumerary cross veins and spurs of veins, so common in Tipulidae, indicate the location of some few remnants of the large numbers that were probably possessed by the early neuropteroid ancestors of the Diptera. It may be assumed that in any process of reduction cross veins favorably situated, joining the principal veins advantageously, would tend to grow stronger, while others, less favorably situated in intervening spaces, would tend to weaken and disappear.

Fig. 12

I have drawn and present in figure 12 a typical Tipulid wing in which the principal veins with their full complement of branches are represented in solid black, and the typical cross veins are represented in double contours. This wing is based on a tracing of the wing of Macrochile [pl. 14, fig. 1] and differs very little therefrom. Then, in order to see what sort of wing it would be if all the supernumeraries occurring anywhere in any crane fly should appear together, I located these supernumeraries, all in their proper places, one by one, and I represent them then in dotted lines in this figure. How like a Panorpid wing is the result! If one compares it with the wing of Bittacus, for example, he will see that the differences are very slight, and are confined chiefly to the anal area. There is the same type of branching of all the

[1] U. S. Nat. Mus. Proc. 1903. 26:703–64. A Genealogic Study of Dragon Fly Wing Venation.

principal veins, the same upward hitch of vein Cu^1 against media, and many of the cross veins occupy identical positions. Especially striking are the first two cross veins in the first fork of media, one delimiting, the other traversing cell 1st M^2. The suggestion has been made before by others, and I think it very possible, that some Panorpidlike neuropteroid mutant got its center of gravity hitched forward, its hind wings reduced, and started the dipterous line of evolution.

Homologies of cross veins. In my study of the venation of the Odonata, I was quite unable to homologize any of their cross veins with those found in other orders of insects. And I do not believe that those indicated in the Comstock-Needham typical wing are necessarily homologous, even in those orders in which single cross veins occur at the points indicated for them in our type, for, primarily, cross veins are not formed about strong tracheae (they contain either late developing tracheal twigs or none at all), and they show, so far as I can see, none of the earmarks of homology. I conceive that such cross veins, as we may fairly regard as typical by reason of their frequent recurrence, are the survivors of the long elimination process just discussed. They are the cross veins that happened to stand in the positions most favorable for connecting together longitudinal veins, ordinarily at the points where dichotomous branches came nearest together. If, as seems probable, there were originally many cross veins, and if the forks of the principal veins varied somewhat in length and position in the ancestors of different groups, the same particular cross veins might not, probably would not, be preserved in every case. Those most useful would, naturally, survive the elimination process. Yet, with a similar form of wing and the same general primary disposition of branches of tracheae and veins, the process of elimination might leave a few strong cross veins in corresponding positions in very different insects, for it is always to be remembered that all wings have had to meet like conditions: the air is the same for all. The cross veins of the Comstock-Needham type are such merely as recur in like position in a large proportion of winged insects, and whether strictly homologous or not, it is convenient to designate them by the simple method that Professor Comstock devised. It is in this sense that these designations are used in this paper.

Some general features of the Tipulid wing

The primitive ancestral crane fly doubtless possessed more veins in its wing than were necessary or advantageous, and these were

not well arranged to serve the purposes of flight. A comparison of the generalized members of the family with the more specialized, gives unmistakable evidence as to this, and a comparison of the Diptera as a whole but adds further confirmation. The best flyers have fewer veins, and have them arranged in such a manner to better brace the wing membrane.

The course of primitive veins was probably one of gentle divergence out from the narrow base across the wing disk. Their forking was dichotomous; in all wings there still inhere some traces of this original dichotomy, that is due to the first formation of veins about primeval tracheae. When elimination of cross veins occurred, those cross veins would be preserved that occupied advantageous position joining the nearest points of adjacent veins. For the wing is a machine, and one of immense importance to its possessor, and its efficiency would count for much in the struggle for existence. That efficiency could depend on nothing else than advantageous arrangement of its constituent parts.

The wing is moved up and down by muscles within the thorax attached to its basal parts; its front margin is rigid, by reason of the strength and close approximation of the three veins there and the gutterlike depression of the membrane they maintain between them, their close union with the basal hinge apparatus, and their junction at the humeral cross vein and by means of the tip of the subcosta. At the tip of the subcosta lies the stigma — a weighted striking point, strongly, though often diffusely chitinized. This is the point of greatest impact against the air. The part beyond the stigma and the whole outer and hinder border are flexible; and forward progression through the air depends upon the sculling action which this combination of rigid front margin and pliant hinder part secures.

The wing has been called not inaptly "a sort of flexible sail;" and if we scan any Tipulid wing (excepting possibly a few of the most generalized) we may readily see that the strong main stem of the radial vein stands in the place of the main mast, [fig. 11] and the strong cubital vein, in the place of the boom that keeps the sail full spread. From an imaginary mast head in the region of the stigma a sort of "bolt cord" is formed out of cross veins and divaricated forks, joining together in secure but flexible union the outer ends of mast and boom. Moreover, as were befitting in a sail, the base of the main mast is rigid, while the base of the boom is flexibly slung.

But this analogy might easily be carried too far. For the wing is not a sail, to belly with the wind and hold against its pressure, but it is a flexible scull, to be swung rapidly against still air, up and down, rigid in front, yielding behind, giving a resultant in forward motion of both strokes rapidly repeated. Hence beyond the bolt cord that may be discerned in the line of cross veins and forks; and behind the boom that the stem of the cubital vein represents, there is a wide border that has no counterpart in a sail. Furthermore, the analogy will be misleading if held too rigidly even for the inner triangular area. For the "bolt cord" is often not continuous to vein R[1] but stops at the radial sector,[1] and it is cut by one or more furrows, that greatly increase its flexibility.[2]

The analogy will have served its purpose if it fixes our attention upon the triangular outlines of the supporting framework of the wing, for it will abundantly appear in the following pages that along these lines of support have played the forces that have evolved the Tipulid wing.

This general arrangement of parts is not peculiar to Tipulidae, nor even to Diptera, but is characteristic of the vast majority of winged insects. It seems strange that so little attention should have been paid to it hitherto by students of venation. I desire to emphasize it here by means of the accompanying diagram [fig. 13] in which the arrows indicate the outer line of transverse joinings. For this I think it would be convenient to use the simple and suggestive term *cord*. The shaded mainmast strip at the front is the costo-subcosto-radial combination. The posterior boundary of the larger triangle is the cubitus, and of the lesser included triangle, the radial sector.

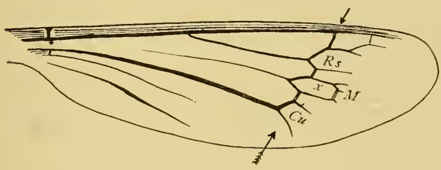

Fig. 13

[1] Thus making, however, a trapezoidal, instead of a triangular sail area.

[2] These furrows allow the wing to close somewhat on the up stroke, and are doubtless a compensation for the pull of gravity on the heavy body of a crane fly. They are best developed in the Tipulinae with the heaviest bodies (Holorusia, etc.). One can see how they work by holding a fresh or a softened wing firmly by its base and blowing air alternately against its upper and lower surfaces through a bent tube while looking horizontally at its tip. The anal furrow (behind Cu) allows almost complete flexion on the up stroke. On the down stroke the whole wing tends to flatten out.

The main phenomena of specialization of wings of crane flies are three:

1 The bringing into line for mutual support of cross veins and adjacent forks. This may be soon understood by comparing figures 12 and 13, or by comparing any specialized crane fly wing with the wing of Macrochile [pl. 14, fig. 1].

2 The reduction of superfluous veins and cross veins.

3 The differentiation between the veins that remain.

The last two processes are really one; for both are at bottom and redistribution of the strength-giving material of the wing. When but one cross vein is left where two were before, that one is larger and stronger. This may be perhaps regarded as hypothetical, but the converse of it is not, for two cross veins occasionally appear adventitiously, where normally there is one (as, for example, cross vein *m* in Acyphona) and then they are always markedly weaker than the single one would be. The differentiation between longitudinal veins consists likewise essentially in putting the strength-giving material where it will do the most good. That differentiation is but little exaggerated in figure 13. Witness the photographs of plates 11 to 13. Strong and weak stems alternate.[1] Radius is strong and media weak, cubitus is strong and the first anal weak, the second anal is stronger than the first, and the third is usually absent altogether.

Our knowledge of the mechanics of insects is yet exceedingly meager and unsatisfactory. It is sufficient to be suggestive however of possible reasons underlying the main phenomena of their specialization.

Elements of the venation individually considered

It will be advantageous now to consider the parts of the venation severally, looking first at the veins, then at the cross veins, and then at their mutual behavior and adjustment.

Longitudinal veins. The costa is always simple, and forms the front border of the wing.

The subcosta is a weaker vein that lies in the bottom of the furrow of the fore border between costa and radius. It is bound to radius by a basal fusion and to costa by the humeral cross veins:

[1] I have noted a similar differentiation under very different vein arrangement in the Odonata [U. S. Nat. Mus. Proc. 1903. 26:737], and have stated the conclusion thus: "The strong vein bounds posteriorly the area in which the weaker one lies."

at its tip it is forked, and its short divaricated branches have the appearance of cross veins. Sc^1 joins the costa directly, and Sc^2 (the so called subcostal cross vein of some systematic dipterologists) joins radius. Specialization affects the subcosta very differently in different groups of crane flies. In some (Limnobiini, etc.) the apical fork becomes strongly fixed in the position described so as to maintain a deep furrow all the way to the stigma. In some (Pedicinii, etc.) Sc^2 migrates backward toward the base of the wing [*see* pl. 24, 25] and in some there is a marked tendency for one tip or the other or even the whole of the subcosta to atrophy (Rhamphidiini, etc.).

The radius is the strongest vein of the wing. It is typically five branched, the sector being dichotomously twice forked. This is the condition seen in Macrochile [pl. 14, fig. 1], Idioplasta [pl. 15, fig. 1], and Tanyderus [pl. 14, fig. 2]. Usually the number of branches is reduced, and when reduction occurs it follows a different method in the two families of crane flies. In the Ptychopteridae, fusion proceeds faster in the upper fork of the sector, veins R^4 and R^5 remaining separate after veins R^2 and R^3 have fused, as seen in Ptychoptera and Bittacomorpha [pl. 15, fig. 2, 3]. Since this is the behavior of the sector that characterizes all the brachycerous diptera, and since crane flies belong to the nematocerous division, its occurrence here is somewhat surprising. In nearly all Tipulidae fusion proceeds faster in the lower fork of the sector, veins R^2 and R^3 remaining longer separate. There are, however, a few genera, scattered among the various tribes, as these tribes are at present constituted, in which there is considerable variability as to the nature of the forking of the sector. The apparent exceptions to the rule just stated for the Tipulidae proper, occur in Pedicia [pl. 26, fig. 1] and Amalopis [pl. 25, fig. 2] of the Amalopini. In Molophilus [pl. 22, fig. 6] and Conosia [pl. 21, fig. 5] of the Eriopterini, and in Rhicnoptila [pl. 30, fig. 5] of the Limnophilini. Indeed, in *Amalopis inconstans*, and in *Rhicnoptila wodzickii*, and probably in others of these forms, both types of forkings may be found in a single species. This is

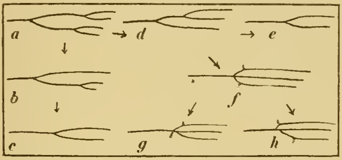

Fig. 14

very puzzling; for such characters as this have been found elsewhere in the Diptera most reliable. But it is to be noted that in all these cases of departure from the assumed Tipulid type of forking of the sector, the branches are all long and the forks lie close together, and a slight migration of either of the three branches would change the relations of the forks to each other. The accompanying diagram illustrates these differences of behavior of the radial sector. There are some reasons for believing that these peculiar forms are only apparent exceptions to the rule of Tipulidae. For example, the position of the r-m cross vein in Pedicia, Amalopis and Rhicnoptila, indicates that in these forms at least, after the complete fusion of R^4 and R^5, a further fusion of R^{4+5} with the part of the sector immediately before it, brought about the apparent reversion of the fork; for, elsewhere when the sector is three branched, this cross vein touches the posterior branch *after its separation from the middle branch* but here it touches before this separation [fig. 14*g*]. In other words, the r-m cross vein remains in its original position, while fusion has carried the fork past it. A reason for that further fusion may possibly have lain in the arcuation of the wing apex in these genera.

In Gynoplistia [pl. 20, fig. 1] the fusion has proceeded only to the level of the cross vein, and the two forks are of equal depth. In Molophilus (not Erioptera) comatus Doane [N. Y. Ent. Soc. Jour. vol. 8, pl. 7, fig. 20] the forks are symmetrically arranged about the middle branch [like *f* in fig. 14]. Obviously this condition, although intermediate, is not primitive, but secondary, and has come about through migration of one or the other or both of the forks.

To the other cases in which this exceptional mode of branching of the sector occurs, Conosia [pl. 21, fig. 5] and Molophilus [pl. 22, fig. 6] the same reasons for this second fusion will not apply: the wing tip is not arcuated, but straight. But in both of these the r-m cross vein is located unusually far out from the base of the wing, especially in the former, and this secondary fusion may here be an accompaniment of the upward skewing of the sector, and the unusual relations borne by the elements of the cord [fig. 14*h*].

Professor Comstock pointed out that the two modes of branching of the sector are differences of kind, and he showed that by further reduction either kind of three branched sector

may become two branched. And, if the two branched sector at *c* in figure 14, and the one at *c*, exactly like it, be descended as indicated, they are less closely related to each other than either is to the three branched sector that stands before it in the diagram. Yet when the two types of branching are hovering about the parting of the ways, as they seem to be in the cases just cited, we see that even differences of kind are in their beginnings merely differences of degree.

This marked variability in a character that is elsewhere so constant and so important surely indicates that the crane flies are a very generalized group. In this, and in other characters as well, the main characters of the venation of the Diptera were not firmly fixed. The crane flies stand near the foot of the series, where venational experiments abound, and where the main trends of specialization are not everywhere fully established.

A further reduction of the branches of the sector has occurred in many crane flies [*see* pl. 27, 28]. The two branched condition has been reached, apparently by the fusion from the base outward to the wing margin of R^2 and R^3, as illustrated by Gonomyia [pl. 24, fig. 4, 5] and Cladolipes: also by the atrophy of vein R^2, as indicated by Lipsothrix [pl. 20, fig. 5] and some Tipulinae. Apparently R^2 and R^3 have both atrophied in Toxorrhina [pl. 29, fig. 5]. There has also occurred a noteworthy fusion from the tips backward of R^1 and R^{2+3} in the Cylindrotomini [pl. 15, fig. 4, 5, 6]. Certain other fusions involving also the cross veins, will be considered after the cross veins have been discussed.

The median vein is typically twice dichotomously branched, like the radial sector. Yet even more rarely does it show the full complement of branches. These were apparently fully developed in the fossil crane fly Rhabdinobrochus [pl. 17, fig. 2] from Florissant, and all four are represented in a living undetermined Tipuline shown in [pl. 17, fig. 1], although M^3 is represented only by a spur of a vein. Usually there are but three, or two branches: rarely there remains but one [as in Diotrepha, pl. 29, fig. 6]. The branches of the two main forks of media tend to be reduced by different methods; those of the anterior fork tend to fuse from the base to the wing margin; those of the lower fork to disappear by atrophy. I have not found any evidence of atrophy in the anterior fork, nor of fusion in the posterior one. A number of the larger genera, like Limnophila,

illustrate in their different species the tendency of M^1 and M^2 to fuse together. Limnophila toxoneura [pl. 18, fig. 2] shows a moderate fusion; L. brevifurca [pl. 14, fig. 6] shows fusion almost to the wing margin; and L. quadrata [pl. 18, fig. 6] shows the fusion complete; and the other species of Limnophila figured on plate 18 show various intermediate conditions. Rhaphidolabis [pl. 19, fig. 2] shows these veins almost fused, and the nearly allied Plectromyia [pl. 30, fig. 4] shows them wholly fused.

In the hinder fork, I have seen no evidence of any tendency for M^3 and M^4 to fuse, but both tend to atrophy. Both, though commonly developed in the more generalized neuropteroid insects, have been found well developed among all the Diptera only in the fossil Rhabdinobrochus above cited. One of the hinder branches of media is quite persistent. In fact it is nearly always present, but it may be found well developed or weak or broken or absent in different species of the genus Dicranomyia. It is usually fused basally with vein Cu^1 for a distance, but I have never found it fused beyond the level of the median cross vein, and I do not believe that it ever disappears by total fusion in the Tipulidae, although it does so among certain of the higher Diptera. Dicranomyia immodesta [pl. 27, fig. 3] shows it persistent while the median cross vein has disappeared, D. cinerea [pl. 27, fig. 4] shows it interrupted, and attached to the end of the flexed median cross vein, the two together simulating very deceptively a persistence of vein M^2. This appearance is wholly deceptive, however, as any one may satisfy himself by a little careful comparative study. In ? D. whartoni [pl. 27, fig. 5] it has wholly disappeared, save for the slightest bit of a spur on

[1] Critical comparative study is sometimes necessary for determining where vein *R* ends and vein *M* begins. In Paratropeza [pl. 21, fig. 4], for example, there are five branches of veins reaching the wing margin between the tips of R_1 and Cu_1. Is it *Rs* or *M* that is three branched? How shall this be determined? Only by comparison of allied forms. It will thus become sufficiently clear that *Rs* is three branched. The other interpretation would be inconsistent; for (1) the first fork of the vein *Rs* is always involved in the formation of the cord; vein R_{4+5} is here set off posteriorly at a right angle from the base of vein R_{2+3}; and (2) in allied forms the cross-vein *M* joins at its anterior end vein M_{1+2}, not vein M_2; that is, it is situated on the proximal side, not on the distal side of the upper median fork. That fork is therefore not present in Paratropeza. This apparent confusion is due to the elimination of the *r-m* cross vein by the long basal fusion of veins R_{4+5} and M_{1+2}.

the anterior side of Cu^1, marking the point of their former separation.

The cubital vein is always two branched, and is the most constant of the veins of the wing. Its anterior branch Cu^1 is always deflected forward at the fork, toward a backward deflection of M^{4+5}. The posterior branch is often recurved at the tip, and is rarely (as in certain tropical species of Eriocera and Mongoma) [pl. 21, fig. 6] fused with the tip of the first anal. The further changes in this vein are connected with the elimination of the medio-cubital cross vein and will be discussed later.

The second anal vein is branched in Podoneura [pl. 21, fig. 3] and apparently also (and still more deeply) in Peripheroptera [pl. 28, fig. 4], if I rightly interpret this figure as showing a first anal vein greatly reduced. I am quite unacquainted with the species except for this figure. There is a very short branch at the tip in the aberrant Australian Limnophila, figured by Skuse [Linn. Inst. N. S. Wales. Proc. (2) vol. 4, pl. 22]; and in a number of our commonest crane flies [such, for example, as Helobia, pl. 24, fig. 1] the tip of it is very like that of Podoneura with the posterior branch of the fork eliminated; and in Trichocera [pl. 19, fig. 4] its strong recurvature resembles that of Podoneura with the other or anterior branch eliminated. Possibly, the supposed supernumerary cross vein between the anal veins in Discobola [pl. 28, fig. 1] may be the anterior tip of A^2, deflected and fused with A^1.

The third anal vein appears to be present, and distinct and free from the anal margin only in the Florissant fossil crane fly Cladoneura [pl. 22, fig. 1].

Cross veins. I have already indicated by name the five cross veins that I regard as typical for Tipulidae: the humeral (*h*), the radial (*r*), the radio-medial (*r-m*), the median (*m*), and the medio-cubital (*m-cu*).

There are perhaps a few others that should have been taken into account, situated at the base of the wing on the posterior side. The foremost of these with which the base of the median vein is intimately bound up, extending between radius and cubitus, is doubtless the same as the arculus in other orders. The others have been called collectively and without discrimination, axillary cross veins. My material being largely published figures, has not been adequate for their study. No attention has yet been paid to them.

The "subcostal cross vein" of many systematic dipterologists is not included in this list because it is not a cross vein at all, but the free part of Sc^2 as already pointed out. The basal one of these five cross veins, the humeral, is very constant in position and relations, only disappearing by atrophy when the subcosta, which it braces, atrophies.

Of the four distal cross veins, the two innermost (*r-m* and *m-cu*) lie between principal veins and effect strong and permanent unions. The other two (*r* and *m*) lie in the middle of the principal forks of the radius and of media respectively, usually fall outside the cord and are far less constant. These two disappear by atrophy; the former, only by fusion of veins together, making the joinings stronger. The radial cross vein may enter strongly into the formation of the cord, as in Conosia [pl. 21, fig. 5] and the more typical Eriopterini [pl. 23] or it may be quite eliminated as in many of the Rhamphidiinae [pl. 29] and Paratropeza [pl. 21, fig. 4]. It rarely disappears through the fusion of adjacent veins, as in Lechria [pl. 19, fig. 5]; more often it is eliminated by fusion from the apex backward as in the Cylindrotomini [pl. 15, fig. 4, 5, 6]. Its position in relation to the forking of the radial sector is very different in different crane flies; and in this there probably lie unused generic characters of value.

The radio-medial cross vein always enters into the formation of the cord, being always present or accounted for. It disappears only by fusion of adjacent veins upon it. That fusion may be brief, as in Rhamphidia [pl. 14, fig. 4] or more extensive, as in Ptilogyna [pl. 17, fig. 4], Liogma [pl. 15, fig. 5], Mongoma [pl. 21, fig. 6], or Paratropeza [pl. 21, fig. 4], each representing a different group, and all highly specialized. It is situated at an unusual distance from the base of the wing in Conosia [pl. 21, fig 5], being beyond the median cross vein.

The median cross vein usually lies without the cord (except in the case of Conosia, just cited) and when far without, it appears to be relieved of great responsibility and tends to disappear along with the superfluous branches of the median vein. As a rule it disappears in advance of the atrophy of M_3. Owing to the upward deflection of the base of M_3, this cross vein and the deflected portion of that vein equally support the tip of M_3 in very many cases; and either may be eliminated, leaving the tip supported on the other. In fact both may go, and leave the tip hanging in the membrane unsupported, as illustrated

in figure 14, *i, j, k, l, m.* Within the limits of two genera, Dicranomyia and Rhypholophus, as these are at present constituted, both occurrences may be found in different species. This is illustrated for Dicranomyia on plate 27, figures 3 and 4. But it seems to me that the differences of stress must be considerable in wings so differently veined as are these, and that the disappearance in the one case of the cross vein, and in the other, of the base of M^3 are really differences of kind sufficient perhaps to justify generic separation. Obviously the stresses in the wing shown in figure 4 of plate 17 would be distributed much as in the wings of the Gonomyias shown in plate 24, figures 4 and 5, in which a parallel atrophy of the base of M^3 has occurred.

The medio-cubital cross vein is present in a considerable number of the more generalized representatives of this family [witness pl. 17, fig. 1, 2, 4, 5, 6; pl. 14, fig. 1, 2; pl. 16, fig. 1, 2, 4, 6] and it is accounted for in all the others by the fusion of M_3 and Cu^1 upon it. This fusion is never very extensive in the Tipulinae, but it is usually considerable in the Limnobiinae, and after it occurs the deflected portion of Cu^1 looks like a cross vein; and it is so designated by some dipterologists. After this fusion is completed the deflected portion of Cu^1 may migrate toward the base of the wing, to a moderate extent in Hoplobasis [pl. 23, fig. 5], Trimicra [pl. 24, fig. 4], Helobia [pl. 24, fig. 1] and Empeda [pl. 14, fig. 5] — to a remarkable extent in Diotrepha [pl. 29, fig. 6].

The supernumerary cross veins, whose location has already been indicated in the diagram [fig. 24], are distributed in part as follows, the names of the cells being those of the veins that bound them anteriorly. The one in the costal cell occurs in Ephiphragma and several related genera. That in cell R^1 occurs in Dicranota, Polyangaeus, Peripheroptera, etc. The one in cell R^2 occurs in Rhicnoptila, Helobia, Limnophila, etc. The one in cell R^3 occurs in Tanyderus, Polyangaeus, etc. The one in cell R^4 occurs in Tanyderus. The one in cell R^5 occurs in Cyttaromyia, and gave the describer of that fossil considerable trouble. The one that occurs in the base of cell R (the first basal cell of some systematic dipterologists) occurs as a spur from the base of the radial sector in many genera. The one in the middle of that cell occurs in an Australian aberrant Limnophila that was figured by Skuse[1]. The one in the apex of that cell occurs as a spur projecting from the radio-medial cross vein in Trichocera and from M^{1+2} in a number

[1] Linn. Soc. N. S. Wales. Proc. (2) 4 pl. 22, fig. 25.

of other forms. The one within the discal cell occurs in Hoplolabis, Plusiomyia [pl. 17, fig. 2], Ula [pl. 25, fig. 5] and as a spur in others. The one in cell M (the second basal cell, of some systematic dipterologists) occurs in Ephelia, Polyangaeus, etc. The one in cell M_3 occurs in Idioplasta. The one in cell A^1 occurs in Discobola. The probable significance of all these supernumeraries has already been discussed. I consider them lone survivors of a more abundant venation. But their widely scattered recurrence inclines me to believe in a very remote origin of genera and groups of genera in this family.

And there is among them one that is very peculiar. Apparently it is not in the way of disappearing, but of redevelopment. It is the one that occurs in Hoplolabis armata in cell 1st M^2. There is here a curious atrophy of the base of M^{1+2}, just beyond the first fork of the median vein and a creeping of all the vein tips around toward the wing apex, and a most curious conformation of the discal cell [pl. 23, fig. 5, 6]. It acquires a reentrant angle from which a spur starts. These things are foreshadowed in Acyphona [pl. 23, fig. 4]. I studied the variability of this spur in some 50 wings of this species, and found it to exhibit all degrees of length from a complete cross vein down to a spur one third as long, it being usually about half as long. This seems to be a relatively new acquisition that accompanies the reentrant angle that probably meets some new need due to the movements of veins and shift of stresses.

The median cross vein rarely disappears by the fusion upon it of the veins it connects [as in Phalacrocera pl. 11, fig. 2, and in Idiophlebia figured by Grünberg in Zool. Aug. 1903. 26:525]. It gets curiously reduced in length and reversed in position in Palaeopoecilostola [pl. 20, fig. 4].

Principal readjustments of venation in the Tipulidae

We come now to note the correlated behavior of veins and cross veins in this family. The principal shifts of veins that clearly show correlated movements of many elements of wing structure are two: (1) the formation of the cord and (2) the upshift of veins Cu^1 and M^{3+4}. Let us consider these somewhat in detail.

Formation of the cord. As already defined, the cord is the principal line of transverse joinings of the veins that traverse the wing disk. It is always composed of at least three forks and two intervening cross veins. These are the first fork of the radial sector,

the first fork of the media, the fork of cubitus, the radio-medial cross vein, and the medio-cubital cross vein. Primitively the cord was very much zigzagged in and out, and secondarily it often becomes quite straight, but whatever its shifts of position, its ins and outs, it is always clearly recognizable, and the parts just cited are its essential parts. It is always attached to vein R^1, but there is the most extraordinary diversity in its mode of attachment. It may, with the aid of the radial cross vein, be slung from R^1 upon a truss of equal arms (the arms being the base of Rs and portions of R^{2+3}, *see* plate 29) ; or, the distal arm may be shortened, as in a host of forms (as indicated in the diagram fig. 11) ; or the proximal arm may be shortened as in Dolichopeza [pl. 16, fig. 5] ; or both arms may be shortened simultaneously as in Cryptolabis [pl. 30, fig. 1] and Peripheroptera [pl. 28, fig. 4] or the radial cross vein may come into a position of increased responsibility as in Conosia [pl. 21, fig. 5] or may be brought into direct line with the cord, as in Paratropeza [pl. 21, fig. 4] ; or, the radial cross vein may atrophy, as in a host of forms, leaving the cord supported by the base of the sector alone; or, the opposite thing may happen; the tip of R^2 may turn forward and fuse with the tip of R^1, thus eliminating the radial cross vein, with the usual result of leaving a very strong union in its place; and the vein R^3 may follow it, and the base of the sector may atrophy, leaving the cord slung from the radius by R^{2+3} alone, as in Scamboneura [pl. 16, fig. 6]. But, these shifty parts aside, be it noted that the foremost fixed point in the cord is the first fork of the radial sector, and the hindmost point is the fork of cubitus, and between these two points it had primitively a zigzag, in and out course, which has been corrected, shortened and improved chiefly by the shortening of these forks, and the divarication of their branches.

This path of union traverses the cell 1st M^2 — one might say, is interrupted by that cell. Probably the cell 1st M^2 and probably the entire median vein with it, might well have been dispensed with, for the more successful of the Diptera have either eliminated it, or brought it into quite new relations to adjacent veins. But it was present, and its principal fork was interposed squarely between the forks of the adjacent veins. That is the burden of inheritance; for the wing was not made out of dreams, as some might have us think — out of hypothetical *a priori* fitnesses — out of vacancy, to which parts might be added in a rational and beautiful manner, but out of a fold of hypodermis, traversed by branching tracheae, and secreting chitin about them and between them. The

early differentiating process had to deal with a long median fork, with a cross vein at each elbow of it. But the median cross vein standing in its midst and binding its arms together beyond the cord and opposite the fork, preventing their spreading, clearly corrects in some measure the obvious weakness of this arrangement.

In our diagram [fig. 13] the cell is represented between the cross veins and adjoining forks, like a ring slung in a cord. It required the median cross vein to complete the ring. This is the reason why that cross vein is far more persistent than any other outside the cord. There can be no doubt of this, for that cross vein disappears only when the cord is shifted to the proximal end of cell 1st M^2, and it is thereby put out of commission. The testimony of the figures in the plates given herewith is unmistakable as to this. Very rarely, as in Conosia [pl. 21, fig. 5], there is a shift of the cord distally, which brings the median cross vein more directly[1] into the line of stress: in such a case it would never be lost.

The forward shift of veins Cu^1 and M^3. The tendency of vein Cu^1 to be deflected forward at its base and strongly joined to media has been noted in the preceding pages. The accompanying diagram [fig. 15] illustrates successive stages in the progress of that tend-

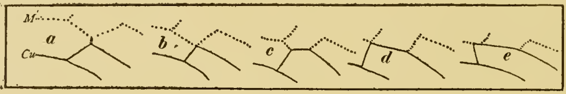

Fig. 15

ency. All these are abundantly illustrated in the plates accompanying this paper, and one figure, that of Diotrepha [pl. 29, fig. 6], illustrates a far more extreme case. By the means here shown the tip of the vein Cu^1 comes to be attached directly upon the base of media and in direct line therewith, and it has been usually interpreted as a branch of the same. Ordinarily, this union is a strong one, and the deflected portion of Cu^1 is one of the stoutest veins of the wing, as it is in many other Diptera. But among the crane flies are found

[1] It may be noted in passing that in the Lepidoptera an outward shift of stresses, somewhat like that shown in Conosia, has brought the median cross vein permanently into the cord, and the other proximal part of the first median fork has atrophied, leaving three cells, the so called first and second basal cells and the discal cell of the dipterous wing, to constitute together, when their intervening boundaries are atrophied, the "discal cell" of the Lepidoptera.

many aberrancies; and there is one here in the little group of genera of more typical Eriopterini shown on plate 23. The upcreep of the tips of the two veins under discussion toward the apex of the wing has already been noted in an earlier place for its effect upon the development of the cell 1st M^2. It is also noteworthy for having relieved the deflected base of M_{1+2} of its ordinary responsibility. That deflected portion in Mesocyphona tends to atrophy, and thereby to reduce the rearward extension of the cord.

In like manner vein M^3 is deflected upward just beyond its union with Cu^1 and thereafter it tends to atrophy as in Dicranomyia, or to be reattached to vein M^{1+2} in the manner already discussed, and more fully illustrated in the accompanying diagram [fig. 16].

If any one would comprehend what has happened to the median vein in the Tipulidae, let him study the wings of the plates carefully in comparison with this diagram. *a* is the hy-

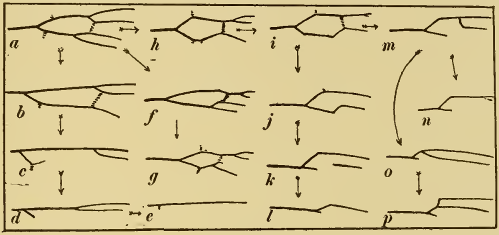

Fig. 16

pothetical typical media, with the dotted lines in this and in all the following indicating the positions of the cross veins. *b, c, d* and *e* represent the Ptychopterid line of specialization. *b* is Macrochile, with the media reduced to three branches; *c* is a hypothetical form introduced to account for the disappearance of the posterior division of the first median fork[1].

Material is lacking to fill this gap, and another interpretation is possible: i. e. that, starting with a form somewhat like Megistocera [pl. 16, fig. 4] the median cross vein has been lost and the branches have regularly and progressively fused together, M^1 and M^2 completely, leaving these same two tips in Ptychoptera to be designated as M^{1+2} and M^3. But the first interpretation is certainly admissible, from the frequent tendency of M^3 and M^4 to atrophy; and it is rendered much the

[1] This makes two tips of media remaining in Ptychoptera M^1 and M^2.

more probable by reason of the fact that in the more generalized Ptychopteridae, Macrochile [pl. 4, fig. 1], Tanyderus [pl. 4, fig. 2] and Idioplasta [pl. 5; fig. 1], M^3 is strongly deflected toward the forward basal deflection of Cu^1, and strongly attached thereto; and there is no reason for believing that this union, so important and constant a feature of the cord, once attained would again be lost in this series.

This conclusion involves, however, a departure from the interpretation Professor Comstock has given for the branching of the median vein in Dixa and perhaps in other nematocera. Dixa is nearly enough allied to Ptychoptera so that I must hold the same interpretation for it. I would label the tips of its median vein as M^1 and M^2, and not as M^{1+2} and M^3. But, I hope some day to have opportunity for studying other nematocera and establishing this matter by more abundant evidence.

f in the diagram represents the condition of the median vein found in the fossil Rhabdinobrochus as figured by Scudder. It is fairly typical. And taken in connection with the apparent spur or rudiment of M^3 shown in figure 1 of plate 17 has tempted me to depart from the interpretation given by Professor Comstock in another more important particular, to change the designation M^3 in all other crane flies to M^4. But a spur in a single wing is altogether insufficient evidence for so sweeping a change. Furthermore, there is in certain Tipulinae[1] a furrow traversing cell 1st M^2 and running outward to the margin which is chitinized along its margins; and it is not impossible that this chitin line may have been the extra vein figured by Scudder, although that would not be characteristic of his marked keenness of observation. I believe that further knowledge of crane flies, both recent and fossil, will prove whether four branches of a median vein are ever present, and if both M^3 and M^4 really occur, in what order and manner they have disappeared.

The ordinary course of reduction of Media is further shown in the figure at *h, i, j, k, l,* none of which is hypothetical. In *i*, vein M^3 is about equally supported at its base upon its deflected base and the median cross vein, and when either support disappears, naturally it is the cross vein that disappears as a rule. But the exceptions are shown at *m, n, o* and *p* of the diagram, in which the deflection at the base disappears, leaving

[1] It is shown particularly well in an undescribed Holorusia in my collection from the Cameroons.

M^3 attached to M^{1+2} by the cross vein, and often remarkably simulating a real M^2. After this shift, it may fuse with M^{1+2} as shown at *n*, or its base may recede to simulate a deepening fork, as in Mesocyphona [pl. 23, fig. 3] as at *o*, and the base of M^{1+2} may even be deflected upward to enter more strongly into the composition of the cord as at *p*, Amphineura [pl. 9, fig. 6].

There are some minor shifts of parts that occur sporadically; the foregoing are the general tendencies. Cell 1st M^2 is shifted very far inward in Lechria [pl. 9, fig. 5], very far outward in Oropeza [pl. 16, fig. 3] and Paratropeza [pl. 28, fig. 4]. The hind margin of the wing is beautifully scalloped in Dapanoptera [pl. 28, fig. 3]. There is a striking decurvature of veins at the tip in Libnotes [pl. 28, fig. 5, 6]. The base of the radial sector is strongly bent in Paratropeza [pl. 21, fig. 4], and more sharply, and with a most curious compensatory adjustment of R^{2+3} in Goniodineura, [pl. 28, fig. 2]. And there are endless other less striking peculiarities of venation occurring here and there. Unlike the higher families of Diptera, no single major trend of venational specialization is firmly established in the Tipulidae. There appear to be grotesque specializations as well as useful ones, and the best flyers are certainly not always those that have departed most widely from primitive conditions.

Recently Professor Williston, while engaged in a well meant effort to rehabilitate the outgrown systems of nomenclature with which dipterologists have wrought confusion for several generations[1], has cited some wholly imaginary difficulties connected with Professor Comstock's interpretation of the venation of the Diptera. He thinks it may be the cubital vein that is three branched typically in Diptera, instead of the median; but he gives no evidence tending to support such belief, and it is negatived by the existence of a distinct m-cu cross vein in many generalized Diptera [*see* pl. 4–7] and by the conditions found in other related orders. He further says that he does not at all agree with Comstock in the opinion that when the branches of the median vein undergo reduction, it is vein M^1 that is longest preserved; but he gives not a scrap of evidence

[1] Williston, S. W. *Some common errors in the nomenclature of the dipterous wing.* Psyche. 1906. 13:154–57. The reader is recommended to read this article, and also the remarks of Osten Sacken given by Skuse in Linn. Soc. N. S. Wales. Proc. (2) 5:595–98, beginning with the words on p. 596 "It is a sore subject in Dipterology." Then if he desire further sensations, let him consult Heyden's illustrations of three Loewian systems for as many different dipterous families given in *Paleontographica,* vol. 17, or let him read the section on venation in almost any work on systematic dipterology.

opposed to this interpretation or favoring any other. It seems clear that vein M^1 occupies the more advantageous position; the hinder branches lie in the field in which reduction proceeds fastest, and the stages of their disappearance are easily traced, as has been illustrated for the Tipulidae in the foregoing pages. Undoubtedly, in this family at least, M^1 is the most persistent of the branches of media. On page 155 he says, "If the fourth vein [M] is three branched and the discal cell [cell 1st M^2] present, the vein separating the discal from the second basal [cell M] is of course the first section of the proximal [posterior] branch of the fourth vein [M_3]; if the fifth vein [Cu] is really the one that is three branched, then this vein, at the outer end of the second basal [cell M], is always a true cross vein, which it *always is in the Comstock system when the discal cell is absent.*" The part of this statement italicized above is a complete and incomprehensible misstatement. Vein M^3 in the Comstock system is always M^3, never anything else, whether the cell 1st M_2 be closed or open. Moreover, cell 1st M^2 is merely the space in the basal part of the first fork of the median vein, whether it be delimited externally by a median cross vein or not. It does not depart for other fields when specializations occur about it, but stays in that fork. This is the difference between the Comstock system and the others — it has a morphological basis. It recognizes a difference between principal veins and branches of the same. It does not begin in the middle of the wing to enumerate veins after a few have been dismissed under a different sort of designation. It does not take as its standard of comparison the most specialized of wings with reduced venation. It deals primarily with the real structural entities of the wings, the veins and cross veins, and not with the spaces that these leave vacant.

And the "great cross vein" of Osten Sacken (the basal deflection of Cu^1) will not be greatly helped by calling it some other kind of a cross vein, since it is not a cross vein at all. But neither the Loewian code of medieval terminology, nor the Schinerian version of it — neither as corrupted by Osten Sacken nor as purified by Williston — with its peregrinating posterior cells, its discal cell emitting veins to the hind margin, its cross veins great and small and misconceived, and its wearisome confusion of the simplest elements of the venation, needs that it should be criticized. What these are and whence they came and why they work as they do are self-evident. It were better to say of them that they have served their day and generation.

Table of classification and larval habits of North American crane flies

The numbers in parentheses indicate North American species of each genus.

Family	Subfamily	Tribe	GENERA	LARVAL HABITAT
PTYCHOPTERIDAE	Tanyderinae...		Idioplasta (2).	Unknown
	Ptychopterinae		Bittacomorpha (3).	In red rotten stuff in shoals at head of ponds, etc.
			Ptychoptera (3).	On bottom in shallow, stagnant water
TIPULIDAE	Limnobiinae.....	Limnobini.....	Geranomyia (9)	
			Rhipidia (7).	In brook beds; "in excrement?"
			Discobola (2).	Unknown
			Dicranomyia (39).	In wet, decaying wood; on alga-covered surfaces of wet wood
			Limnobia (20).	In decaying stumps, leaves, etc.
		Antochini......	Toxorrhina (3).	Unknown
			Rhamphidia (2).	Unknown
			Elephantomyia (2).	Unknown
			Elliptera (1).	Unknown
			Orimarga (1).	Unknown
			Atarba (3).	Unknown
			Dicranoptycha (4).	Unknown
			Teucholabis (5).	Unknown
			Antocha (1).	In spring brook beds
		Eriopterini	Cladura (2).	Unknown
			Cryptolabis (2).	Unknown
			Rhypholophus (20).	In decaying leaves
			Erioptera (9).	In water and on shore
			Acyphona (3).	Unknown
			Mesocyphona (15).	Under decaying leaves, etc.
			Haplobasis (2).	Unknown
			Molophilus (8).	In moist earth
			Gonomyia (8).	In drift of stream beds
			Empeda (1).	Unknown
			Helobia (1).	In moist earth by streams
			Chionea (3).	In moist earth
			Trimicra (1).	In drift of stream beds
			Gnophomyia (3).	Unknown
		Limnophilini...	Phyllolabis (3).	Unknown
			Ulomorpha (1).	Unknown
			Trichocera (9).	In decaying matter in swamps
			Epiphragma (6).	In decaying wood
			Limnophila (38).	In moist earth
		Anisomerini....	Anisomera (1).	In moist earth
			Eriocera (26).	Unknown
			Penthoptera (1).	Unknown
		Pediciini.......	Dicranota (3).	In water: carnivorous
			Rhaphidolabis (3).	In beds of spring brooks
			Plectromyia (1).	Unknown
			Ula (2).	In swamps
			Amalopis (11).	Under decaying leaves
			Pedicia (4).	In springs
			Ornithodes (1).	Unknown
			Polyangaeus (1).	Unknown
		Cylindrotomini.	Cylindrotoma (4).	On leaves of plants (Stellaria, Anemone, Allium; green in color)
			Triogma (1).	Unknown
			Liogma (1).	Unknown
			Phalacrocera (1).	In lesser waters on Fontinalis, etc.; green and brown
	Tipulinae........................		Dolichopeza (1).	In or under moist mosses
			Oropeza (1).	Unknown
			Xiphura (4).	In decaying wood
			Ctenophora (5).	In decaying wood
			Pachyrhina (41).	In earth and rotten wood
			Stygeropsis (5)	
			Holorusia (1).	In mud
			Longurio (1).	Unknown
			Tipula (148).	In earth, in mud and in rotten wood

Classification of the Tipulidae or crane flies

It has been one of the great pleasures of my brief study of the Tipulidae to note the broad and catholic spirit in which Baron Osten Sacken studied them and dealt with their classification. I do not always trust the characters he used, but he did not use them slavishly. He was always searching for further light, always open to conviction. I am encouraged to offer a few further notes on his several sections or tribes, by the following invitation contained in his monograph [p. 25]: "The more characters peculiar to each one of the sections we accumulate, the stronger we render the basis on which the classification is established, and the easier the solution we prepare for all future doubtful cases. In this respect a great deal yet remains to be done."

The primary division of crane flies into two families, based originally and mainly on the profound differences in the larvae, finds its venational justification in the distinct behavior of the radial sector and the median vein, as illustrated in figures 14 and 15, and in the absence of a second anal vein in the Ptychopteridae and its presence in Tipulidae.

Ptychopteridae

The Tanyderinae are distinguished by the possession of the full complement of branches of the radial vein. They are in this respect the most generalized of Diptera. Idioplasta is our only representative of the group, which, like many other archaic groups, finds its other representatives in the antipodes (Chili and Australian region), and in fossil remains.

The Ptychopterinae have the radial sector reduced to three branches but with R^4 and R^5 remaining separate however, and they are further distinguished by the absence of Sc^2, by a better developed cord, by the brevity of the base of the radial sector, and by the sinuosity of Cu^2 — all marks of specialization.

Tipulidae

The Tipulinae are distinguished from other Tipulidae by the loss of Sc^1, the skewing of R^2 forward, carrying the cross vein *r* often into a longitudinal position, and the slight tendency toward fusion of Cu^1 with M^3. Within this group the tribe Dolichopezinae appears to be marked off by a tendency of the first fork of media to progress outward beyond the cross vein *m-cu*. I have seen too few representatives of the other tribes of this subfamily, but they are based on antennal characters, for which I have found no venational counterparts.

Limnobiinae. In this subfamily my material has been more abundant. The tribes appear to be founded too often on the presence or absence of parts; and usually it is not the presence or absence of a part that is most significant, but the form it assumes when it is present. Some such characters, however, as spurs and empodia, which Osten Sacken conceived to be rudiments, of no consequence to their possessors he used with great confidence.[1] Ordinarily, these doubtless served him well, but I think they have led to a few incongruous associations of genera. The use of antennal characters hitherto has consisted mainly in the counting of their segments and is very superficial. Of venational characters, he discovered that the branching of the radial sector is much more constant than that of media, but clearly the number of branches of the sector and the amount of retraction of Sc^2 — the characters of which he made most use — are characters of degree only, and like the waning spurs, and imperfect segmentation of antennae, are liable to prove unreliable at critical points. His grouping in sections are in the main natural assemblages, for he based them on keen scrutiny of all the characters he could discover. He was certainly wrong, however, in considering the Limnobiini a group of archaic forms [*loc. cit.* p. 75], for the reduction of branches of the radial sector, of segments in the antennae, and of spurs and empodia, are all departures from primitive conditions.

The Cylindrotomini are distinguished from the other tribes or sections by a pronounced tendency of R^1, R^2 and R^3 to fuse together in one long straight vein tip. *Rs* is always two branched; Sc^2 never tends to recede toward the wing base independently, but the entire tip of *Sc* often atrophies. Media at its first fork is strongly skewed forward, so that Cu^1 is in line with the median stalk, and when veins M^1 and M^2 are both present and separate, M^1 tends to be strongly deflected upward at its base (a condition noticed elsewhere only in Penthoptera.

The Limnophilini are a generalized group of Limnobiinae, and generally lack the special features of the other sections. *Rs* is three branched and typical for this subfamily. *Sc* is usually forked at its tip, except in the aberrant Podoneura and Trichocera. Media is three branched except in Ulomorpha and Phyllolabis [pl. 26, fig. 5] and a few species of Limnophila, and its first

[1] See Osten Sacken. On the atavic index characters, with some remarks about the classification of the Diptera. Berl. ent. Zeit. 1894. 39:69-76.

fork is usually more or less skewed forward, and the anterior deflection of Cu^1 generally meets the middle of cell 1st M^2. In a good many genera the first fork of the radial sector is skewed posteriorly, in opposition to that of media, thus widening cell R. Two aberrant genera Trichocera and Diazoma have the second anal vein short, the deflection of Cu^1 meeting cell 1st M^2 *beyond*, its middle and Sc^2 far retracted. The degenerate Rhicnoptila has the cross vein *r* touching *Rs* unusually far forward and an aberrant type of branching of the sector, both characters seen elsewhere in Amalopis and Pedicia of the Pediciini. Phyllolabis is aberrant also in its abbreviated subcosta, which ends before the origin of the radial sector, in its abbreviated R^2 and in its widening outward of cell 1st M^2— all characters found in Gonomyia.[1] Podoneura is marked by its two branched second anal vein, the recession of the deflection of Cu^1 a little distance within the first median fork, and the recession of Sc^2 already mentioned. There are no highly specialized members of this tribe. Limnophila toxoneura O. S. [pl. 18, fig. 2] is fairly typical.

The Pediciinae show a marked recession of Sc^2 toward the wing base, and a straightening out of the cord. Both Rs and M have usually three branches, the former with the second fork deep and of variable type. Amalopis inconstans O. S. is exceedingly variable sometimes in its venation.[2] But not everywhere and always, for I have been especially looking for variation and have collected this species both east and west in large numbers, and alas, all my specimens appear to be quite normal. This is the only species of Limnobiinae in which I have found the median cross vein touching M^2 after its separation from M^1 [pl. 25, fig. 1]. Dicranota Rhaphidolabis and Plectromyia are set apart by a behavior of the median vein that is just the opposite of that heretofore noted for the Cylindrotomini. The base of it is in direct line with M^{1+2}, and M^3 is offset on the posterior side.

The Eriopterinae constitute a large assemblage of heterogeneous forms among which several distinct groups of genera are seen. The median vein is usually two branched (in Cladura three branched) and the sector is three branched. Molophilus and Conosia tend to depart from the typical Tipuline type of branching of the sector

[1] I believe Phyllolabis Doane should be associated with Gonomyia, but it it is not quite clear to me from the study of the venation alone just where Gonomyia should be located among the tribes.

[2] Witness the figures of Johnson in Entomological News, 12:305, text fig. 1–6.

as already explained in the part preceding; these also differ from all others of the tribe in that the first apparent fork of the sector is skewed upward and the second downward. The shifting of vein M^3 upon the median cross vein after the atrophy of its own basal deflection occurs in Mesocyphona and Dasyptera (subgenus of Rhyphorolophus), in Gonomyia and Trimicra. Outside the tribe this occurs also in at least two species of Dicranomyia and in Elliptera and Thaumastoptera). Sc^2 shows all stages of progress in recession from the tip, and Sc as a whole, and with it R^2, tend to shorten in Gonomyia and its allies. There is a marked convergence toward the wing apex of the tips of most of the veins in the more typical Eriopterini.

The Anisomerini constitute a little group that has been set apart on the reduced number of antennal segments (6–10). In venation it shows in the genus Anisomera marked range of variability in the number of branches of the median vein. The most marked venational peculiarity of the tribe seems to be the wide forking of the cubital vein at an unusually remote point, far outward toward the wing margin. Penthoptera, here figured for the first time, is perhaps as generalized as any member of the tribe. In all, the radial sector is three branched and typical, and Sc^2 remains near the tip of the vein.

The Limnobiini have the radial sector reduced to two branches, and likewise, the median vein, and the cross vein *m* is preserved. There are a few freakish forms included, as plate 18 testifies, but in the main the tribe is one of the most homogeneous. As in Cylindrotomini the median vein is strongly deflected forward at its first fork.

The Antochini is the tribe that contains the extremes of most venational phenomena, the extreme recession of the deflected base of Cu^1 and of the Media in Diotrepha, the extreme reduction of the radial sector in Toxorrhina, and of the angulation of the anal angle of the wing in Antocha etc. Many of the genera are loosely associated.

Many further details of venation applying to groups of genera or to single genera will be found in the key which follows. I have prepared this key based on venation not because I think the venation more important than other structures, but because it may be a means for the communication of some further data, and because I am convinced that some of the best systematic characters which venation offers have been hitherto unused. It should be borne in

mind in using this key, that I have seen but few species save those mentioned in my list or figured in the plates, and other species may exhibit characters different from those I attribute to the genus. Notwithstanding this, the things found in the species I have seen should be suggestive, and should add something to the final working out of the system for this group. It is certain that a thoroughgoing study of the antennae, the mouth parts, the legs, or the appendages of the abdomen would likewise yield valuable results, also, the study of the immature stages, for which I am endeavoring to gather material for future use.

Key to the North American genera of crane flies

(Based on venational characters)

a *Rs* four branched, the posterior fork more deeply branched or, if but three branched, it is R^2 and R^3 that are fused. A single anal vein .... PTYCHOPTERIDAE

b *Rs* four branched, *M* three branched cord deeply indented by first fork of *M*; Sc_2 and cross vein *m* present; Idioplasta only. . TANYDERINAE

bb *Rs* three branched; M^1 two branched; cord not indented by the median fork, Sc_2 and cross vein *m* absent .... *PTYCHOPTERINAE*

c *M* two branched .... Ptychoptera

cc *M* one branched .... Bittacomorpha

aa *Rs* never four branched; when three branched it is R_4 and R_5 that have fused (for a few apparent exceptions, all of which have the forks of nearly equal length, see p. ante). Two anal veins present (three in the fossil Cladoneura) .... TIPULIDAE

b Sc_1 wanting: R_2 directed forward and reduced, or wanting: basal deflection of Cu_1 never extensively fused with M_3 .... *TIPULINAE*[a]

bb Sc_1 usually present and joining the costa beyond Sc_2, which often recedes toward the wing base: sometimes both tips are wanting. Cu_1 usually extensively fused with M_3 at its basal deflection, the cross vein in *m-cu* being eliminated thereby .... *LIMNOBIINAE*

c R_1, R_2 and R_3 extensively fused together from the tips backward in a long, straight vein; *M* skewed forward at its first fork, its base being in line with the tip of *Cu*. Tips of *Sc* often rudimentary. Cross vein *m* never atrophied: *Cylindrotomini*

d M_1 and M_2 separate at tips .... Cylindrotoma

dd M_1 and M_2 fused to the wing margin

e Cross vein *m* present

f Antennal joints subcylindric .... Liogma

ff Antennal joints subglobular .... Triogma[b]

ee Cross vein *m* eliminated by fusion of adjacent veins. Phalacrocera

cc R_1, R_2 and R_3 not all fused together into a long, straight tip

d *Rs* three branched

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a I am not sufficiently acquainted with the genera of this family to attempt a venational key for them. I know only those genera figured herewith and Tipula and Pachyrhina. Antennal characters seem to have furnished the basis for most of the genera.

b Triogma I have not seen.

e Sc_2 present and retracted far toward the base of the wing, it being anterior to the base of *Rs;* forks of *Rs* deep and variable; cord at the first fork of *M: Pediciinae*

f *M* deflected posteriorly at its first fork, its base being in line with M_{1+2}. Cross vein *m* wanting; base of *Rs* shorter than the distance between the forks of *Rs* and *Cu:* (Dicranotae)

g A supernumerary cross vein in cell R_1..............Dicranota

gg No supernumerary cross vein in cell R_1

h M_1 and M_2 separate at the tips...............Rhaphidolabis

hh M_1 and M_2 fused to the wing margin.........Plectromyia

ff The first fork of *M* more symmetrical, M_{1+2} being considerably deflected forward at the first fork. Cross vein *m* usually present: (Pediciae)

g M_1 and M_2 separate to the wing tip

h With a supernumerary cross vein in the cell *Cu,* and others between the branches of *Rs*..................Polyangaeus

hh No supernumerary cross vein in cell *Cu*

i Basal deflection of Cu_1 meets *M* after the forking of *M*

j Wing tip straight, cord transverse............Amalopis

jj Wing tip decurved; cord very oblique..........Pedicia

ii Basal deflection of Cu_1 joins *M* before the forking of *M*...Ornithodes

gg M_1 and M_2 fused to the wing margin....................Ula

ee Sc_2 never retracted toward the wing base so far as the base of *Rs;* sometimes it is wanting

f Cu_2 longer than the deflected base of Cu_1 (antennae 13–16 jointed) *Limnophilini* and *Erioptcrini*

g *M* three branched

h Cu_1 and M_3 fused for a long space, and separating in a symmetrical fork beyond the fusion; cross vein *m* wanting...Polymera

hh Fusion of *Cu* and M_3 moderate, and M_3 deflected forward just beyond it; cross vein *m* usually present

i Basal deflection of Cu_1 meets M_3 at or before the middle of cell *1st* M_2*; 2d A* long; *Sc* forked near its tip

j A supernumerary cross vein present in cell *C*.......... Epiphragma

jj No supernumerary cross vein in cell *C*

k R_3 deflected downward at the second fork of *Rs*...... Cladura

kk Second fork of *Rs* symmetrical, or R^2 deflected upward at its base........................Limnophila

ii Basal deflection of Cu_1 meets M_3 just beyond the middle of cell *1st* M_2*; 2d A* short and recurved; Sc_2 far retracted—almost to the base of *Rs*....................Trichocera

gg *M* two branched

h Area at front of *Rs* undergoing reduction; R_2 returned forward and shorter than the fused portion of R_{2+3}

i Subcosta short, its tip before the base of *Rs*....Gonomyia

ii *Sc* longer, considerably surpassing the base of *Rs*; cross vein *r* present .... Empeda

hh R_2 longer than the fused portion of R_{2+3}

i *Rs* greatly shortened and angulate at its first fork, forming a V-shaped support for the front end of the cord .... Cryptolabis

ii *Rs* normal

j Second fork of *Rs* shifted to the posterior side .... Molophilus

jj Second fork of sector, anterior and normal in position

k A supernumerary cross vein present in the cell R_2; *2d A* strongly bisinuate .... Helobia

kk No supernumerary cross vein in cell R_2; *2dA* not strongly bisinuate

l The tips of the cubital vein showing a tendency to turn toward the apex of the wing

m Cross vein *m* present, and situate nearer to the wing margin than to the fork of *M*, inclosing an unusually long cell *1st* M_2

n Outer border of cell *1st* M_2 sinuate ..Acyphona

nn Outer border of cell *1st* M_2 broken by a re-entrant angle from which springs a spur or a cross vein .... Haplobasis

mm Either the base of M_3 or the cross vein *M* absent, leaving the cell *1st* M_2 open externally

n The cross vein *m* absent; anal veins convergent toward their tips .... Erioptera

nn Base of M_3 absent, its tip transferred to the support of cross vein *m*; anal veins not convergent at their tips .... Mesocyphona

ll The tips of the cubital vein in their normal position, turned away from the wing apex

m The sides of cell *1st* M_2 parallel: the tip of R_2 more or less decurved

n The first fork of *Rs* skewed forward .... Gnophomyia

nn The first fork *Rs* symmetrical .... Limnophila in part and Ulomorpha

mm The sides of cell *1st* M_2 more or less divergent to its outer end; tip of R_2 straight, or slightly recurved

n The deflected base of Cu_1 meets vein *M*, a considerable distance before its fork. The second fork of *Rs* skewed forward .... Trimicra

nn The deflected base of Cu_1 meets vein *M* after or quite close to its fork; the second fork of *Rs* symmetrical .... Rhypholophus

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[a] Also Phyllolabis Doane, which appears to be indistinguishable by its venation from Gonomyia; this is the only Phyllolabis known to me.

ff Posterior end of the cord pushed outward toward the wing margin, making the basal deflected part of Cu_1 longer than Cu_2 *Anisomerini*

g Sc_2 longer than Sc_1; second fork of M unsymmetrical, M_1 at base being deflected forward..................Penthoptera

gg Sc_1 longer than Sc_2; second fork of the median vein when present nearly or quite symmetrical

h Median vein two to three branched; R_2 longer than the fused part of R_{1+2}..................................Eriocera

hh Median vein reduced to a single branch; R_2 shorter than the fused part of R_{1+2}.......................Anisomera

dd Rs two branched ....*Limnobiini* and *Antochini*

e Sc present; Rs arcuated at its origin

f Fork of Rs skewed downward, its base in line with R_{2+3}

g Cell *1st* M_2 or equivalent space widened distally; tip of R_{2+3} curved forward

h Tips of veins R_{4+5} and M_{1+2} arcuated and parallel, but not approximated ....Teucholabis

hh Tips of veins R_{4+5} and M_{1+2} distinctly approximated...... Dicranomyia in part [*see* pl. 17, fig. 4]

gg Tip of R_{2+3} straight; cell *1st* M_2 open

h Cell M much shorter than cell R; cross vein m absent.....................................Orimarga

hh Cell M as long as cell R; base of M_3 atrophied, leaving that vein supported in the reflexed cross vein m..Elliptera

ff Fork of Rs symmetrical, or nearly so

g Cross vein r wanting; R_1 quite separate from R_{2+3}

h R_{2+3} straight and strongly divergent from R_{4+5}; cross vein r-m reduced by fusion of adjacent veins.....Rhamphidia

hh R_{2+3} usually arched more or less; not strongly divergent from R_{4+5}

i Basal angulation of vein M_{1+2} where it touches the cross vein r-m, acute; Sc_2 at tip of Sc; basal angulation of Cu_1 at the middle of cell *1st* M_2..........Elephantomyia

ii Basal angulation of vein M_{1+2} where it touches cross vein r-m, very obtuse; Sc_2 considerably before the apex of Sc_1; Cu_1 joins the median vein at or near its fork.......................................Atarba

gg Cross vein r present, sometimes attached upon the tip of R_1

h A supernumerary cross vein present between the two anal veins in their middle portion..................Discobola

hh No such supernumerary cross vein

i A well marked furrow springing from the middle of *1st* A extends toward the tip of Cu_2...........Dicranoptycha

ii Furrow not so situated, but closer to Cu................

Limnobia, Geranomyia, Dicranomyia in part and Rhipidia.[a]

ee Sc atrophied, *Rs* long and straight to its origin

f Rs two branched; cross veins *r* and *m* present, *Cu* and *1st A* not fused beyond the base, wing widest just before the cord . . . . Antocha

ff Rs unbranched: cross veins *r* and *m* wanting. *Cu* and *1st A* fused for a long distance at base, wing widest just beyond the cord . . . . Toxorrhina

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a I find no venational characters that will separate this group of genera. Rhipidia is well distinguished by the possession of pectinated antennae in the male; Geranomyia, by the possession of a rostrum as long as the body; and while the length of *Sc* has been used to separate Limnobia from Dicranomyia, it is not a sure criterion, for all sorts of intergradations occur. In the former *Sc* is rarely reduced as far as the base of *Rs*, and in the latter *Sc* rarely extends a little beyond the base of *Rs*. Clearly Dicranomyia is polymorphic, as this key indicates, and as has before been pointed out in my discussion of D. cinerea Doane. Perhaps it has become a little more so now by my addition to it of ? D. whartoni. This species has nothing to do with D. cinerea, but represent (after D. longipennis O. S.) the extreme of vein reduction along another line.

APPENDAGES OF THE SECOND ABDOMINAL SEGMENT OF MALE DRAGON FLIES (ORDER ODONATA)

BY

OLIVER S. THOMPSON

The appendages of the abdomen in male dragon flies are of two sorts: those at the end of the abdomen, that are used for capturing the female and leading or guiding her about, and those on or adjacent to the sternum of the second segment, that are used for copulation. The former are probably of more ancient origin; the latter, more recently and secondarily acquired. The former are capable of being homologized with like parts in other orders of insects; the latter are not, being peculiar to dragon flies. Both are of much use in the recognition of species, for the ultimate specific differentiations are oftenest found in these parts.

The occurrence of organs for copulation upon the body at points remote from the orifices of the sperm ducts is, of course, well known in spiders, cephalopods, etc., and the origin of these parts is always shrouded in mystery. In none would the beginnings be more difficult of explanation than in the Odonata. Here the sperm ducts open on the ventral side of the 9th abdominal segment: the copulatory apparatus is on the ventral side of the 2d and 3d segments. Previous to copulation, the abdomen is bent upon itself until the sperm orifice is brought into contact with the sperm vesicle situated at the front of the sternum of the 3d abdominal segment, and the vesicle is charged with spermatozoa. The terminal abdominal appendages of the male are used to seize the female. They grasp her by the head or by the prothorax, and by ventral flexion of the abdomen, swing her into an inverted position, so that her genital orifice, situated on the ventral side of the 8th abdominal segment, may be brought into contact, not with that of the male, but with the accessory apparatus developed upon the 2d abdominal segment of the male. Thus the sperm is transferred. It is a rather remarkable process: how it started almost surpasses imagining.

But we are here concerned only with giving a simple account of what this accessory genital apparatus, developed upon the 2d and 3d abdominal segments of the male, consists of, and how it compares in different genera of dragon flies. As already stated, the receptacle for the sperm is the vesicle, situated at the front of the sternum of the 3d segment in the median line, and visible externally as a rounded prominence. The organ for the transference of the contents of the vesicle to the bursa copulatrix of the female is a median, unpaired, jointed and retractile intromittent organ, the penis. This is situated directly in front of the vesicle, on the sternum of the second segment, and is more or less directly connected with the vesicle. Vesicle and penis are the direct agents of sperm

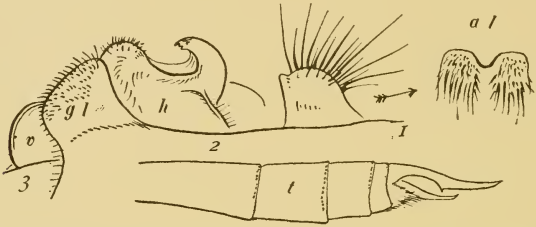

Fig. 17 Male abdominal appendages of the dragon fly Edonis helena Ndm. 1, 2, 3 the three basal abdominal segments and their appendages, inverted and viewed from the side; *v* vesicle; *gl* genital lobe; *h* hamule; *al* anterior lamina, in both lateral and ventral views; *t* tip of the abdomen less enlarged, segments 7 to 10, and appendages

transference: but there are other parts accessory to their function. Beside the penis are one or two pairs of hamules, that assist in maintaining proper positions in copulation. Before the penis there rises from the sternum of the 2d segment a more or less prominent, chitinized, concave arching plate, the sheath of the penis, doubtless with a protective function. All these, and other parts yet to be mentioned, are developments from the sternum: and in the family Libellulidae, the tergum also contributes by the development of the well known "genital lobes" from its postero-lateral angles of the 2d segment. These parts are externally visible. Their general appearance is shown in figure 5, in a case in which but a single pair of hamules is developed. It will be seen that these parts cover only the posterior part of the sternum of the 2d segment, and a bit of the front of the sternum of the 3d segment. It was doubtless in the hollow between these two segments, in the reentrant angle

formed by the infolding of the thin connective there, that the primitive receptacle for the sperm mass, whatever may have been its nature, found its origin. The posterior part of the sternum of the 3d segment is little affected, and the anterior part of that of the 2d segment forms the well known, usually flat, "anterior lamina." If the sternum of each abdominal segment consisted originally of two parts, sternum and sternellum, anteriorly and posteriorly situated, the penis and hamules and their supporting structure may be supposed to have developed upon the sternellum of the 2d segment, while the anterior lamina represents the anterior division, the sternum of that segment.

Figure 18 is a diagrammatic representation of the relations of the appendages to the sterna of the first three abdominal segments (1, 2 and 3). (*a*) is a general sketch of segment 2 with parts of 1 and 3. Segment 2 is divided into *st* sternum

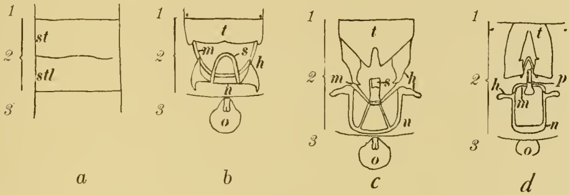

Fig. 18

and *stl* sternellum. This sketch is merely to aid in the location of the complicated parts of the following figures. The second figure (*b*) shows the relation of the genital structures in the Libellulidae. On segment 1 no very prominent structures are noted. Small pits are to be seen just anterior to segment 2. Such pits are found among the Anisoptera and in the Zygoptera, not only on segment 2 but also on segment 3. On segment 2 we have at *t* the anterior lamina, at *m* the anterior portion of the framework which supports the sheath of the penis in Anisoptera and the penis itself in Zygoptera. This part of the framework is firmly attached to and apparently developed from the under side of the anterior lamina. *s* is the sheath of the penis resting on the framework below. *h* is one of the single pair of hamules here developed, attached anteriorly to the framework *m*, posteriorly to the ends of the U-bar *s*. Between and joining these ends of *s* there is only a line of chitin *n* here. This latter is much better de-

veloped in the two following cases. *o* is the conjoined penis and seminal vesicle, developed on the anterior portion of segment 3.

These conditions are typical of the Libellulidae. Genital lobes, not indicated in this figure (but shown at *gl* in figure 17), are characteristic of this family. These occur just outside the hamules and in most cases are well chitinized and hairy. They are lobelike continuations of the tergite of segment 2. The penis found attached to the vesicle on segment 3 in this suborder extends much further on segment 2, but the sketch was made to present as clearly as possible the relations of all the structures and were the penis in its exact place, several other structures would be hidden.

In the next figure (*c*) we show conditions representative of parts as found in family Aeschnidae, differing only in degree from those found in the Libellulidae. Here the anterior lamina (*t*) is cleft in the middle to accommodate the ovipositor possessed by the female in this family, which is directed forward in copulation. At the hind angles of the anterior lamina there is developed another pair of hamules, the anterior ones, clearly marked and extending posteriorly to meet and cover the supporting framework *m*. Where these first hamules are not clearly developed, there is found in all cases a marked development of the anterior lamina and in most cases a tendency toward the formation of the anterior hamules. For example, in Gomphaeschna one pair, the posterior, hamules are found. But seemingly to compensate for what is attained by the development of a second pair, the anterior lamina is highly differentiated, the sheath of the penis is barbed and peculiar lobes are developed on the seminal vesicle which seem to function somewhat like the genital lobes of the Libellulidae. Where genital lobes are well developed, two pair of hamules do not appear.

At *s* is shown a well developed sheath entirely corresponding in position with that of the former figure, only more specialized. This sheath is supported by a framework only a little more complicated than the framework among the Libellulidae, more chitinized in every point and especially marked in the better development of the posterior portion *n* which is only a line in figure (*b*). It is easily seen that the framework is homologous with that of the

Libellulidae. *h* is situated between the first and second hamules. It is my opinion that the first pair of hamules are developments of the posterior and outer sides of the anterior lamina, while the second pair are the terminations of the posterior portion of the framework which swings around close to segment 3 in this figure. This point is discussed, more fully, later. *o* shows the penis and seminal vesicle developed on segment 3.

The next figure (*d*) is a sketch representing the relation of parts typical for the entire suborder Zygoptera. The most apparent difference between this and the two figures explained above is in the location of the penis, *p* this being on the 2d segment here, and seemingly in an exactly homologous position to that of the sheath of Anisoptera. The supporting framework is constructed on the same plan as that of Anisoptera, *m* being the anterior portion which passes under the penis and also under the lobes of the anterior lamina and *n* the posterior portion intimately associated with the hamules *h*. Only one pair of hamules is noted; however, associated with this fact, one must notice the remarkable development of the posterior portion of the anterior lamina of which the lobed portions divided well back, appear like a second pair of hamules, and no doubt so function, while the smaller chitinized structure between the lobes of the lamina and just anterior to and over the penis, formed by an infolding of the under side of the anterior lamina, appears analogous in position to the sheath of the penis in the other suborder. The vesicle *o* is clearly marked on segment 3.

Ontogeny

These peculiar structures develop in late nymphal life. They originate out of folds and thickenings of the epidermis, formed chiefly during the last nymphal stage beneath the chitinized cuticle. By a careful removal of the cuticle, the underlying parts may be exposed to view while still in a very rudimentary condition.

Figure 19 (*m*) represents the 2d segment of a nymph of Libellula pulchella in the last nymphal stage in the ventral view with the cuticle removed, and a cross-section of the same is shown at (*n*). In (*m*), *l* is the anterior lamina; *k*,

the sheath of the penis with indications of the posterior portion of its framework at *g; h,* the single pair of hamules developing upon the anterior portion of the framework *g,* and on segment 3, the penis and vesicle are clearly indicated. The posterior lobe is the vesicle while the anterior lobe is the penis which extends well upon segment 2 in the imago.

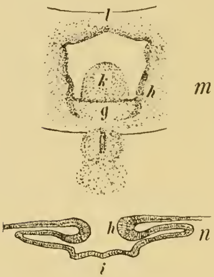

Fig. 19

The cross-section (*n*) made through these parts at the level of the hamules, shows the extent of the ventral pocket that is formed by the overgrowth of the hamules *h.* It shows also at the thickened angles either side of *i,* the points where the thickened margins of the sheath are forming.

The external indications of the structures developing in nymphs on segment 2 are shown in figure 20; (*x*) represents those of Zygoptera, (*y*) those of Libellulidae and (*z*) those of Gomphidae. *n* in each case represents the anterior lamina, *p* the penis in Lestes while *o* indicates the penis and vesicle in the case of Libellula and Ophiogomphus and *u* the vesicle alone in Zygoptera.

In Lestes, the representative of the suborder Zygoptera, one may note that the anterior lamina has already approximated the form found in the imago. The two rounded structures, one on either side of the penis, are the two lobes of the well

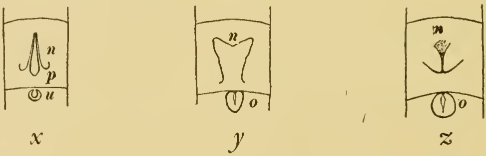

Fig. 20

divided lamina found in this suborder. *u* is the vesicle on segment 3, not so large as the vesicle appears in the Anisoptera because of the fact that on segment 3 in the Anisoptera we not only find the vesicle but the penis closely joined to it.

The space posterior to *n* in Libellulidae (*y*) figure 20 is no doubt the place occupied by the fully developed penis and sheath, now unable to be seen through the chitin. In the more

specialized Libellulinae there are scarcely any indications of these parts in the nymph externally visible, but they are easily recognized in most Corduline nymphs.

In (*z*) two structures are noted meeting in a median line and apparently a part of the lamina anterior to them. These structures are the evidences of the strongly developed first pair of hamules which come from the posterior portion of the anterior lamina. Comparisons of this figure with the imago will bear out this conclusion.

Comparative anatomy of adult forms

Let us now proceed to a more careful examination of these parts and their relations in the several major groups of Odonata, beginning with a generalized representative of the Libellulinae. Figure 21 represents the conditions found in Perithemis. The anterior lamina here (figure 21) *l*; is simple in structure and has already been described, special attention being called to the notches at the sides, and to the lateral divisions marked *k*, for these indicate the source of the anterior pair of hamules. The hamule *h* is attached anteriorly to the portion of the framework which passes forward under the anterior lamina, as well as to *v* which here is only a line of chitin passing posteriorly to the sheath *s*. This line of chitin is to be found in all other forms in both suborders and it seems to be a part conjoining the rear ends of the second pair of hamules. Wherever the hamules are well developed, this line of chitin is well developed, as will be shown farther on. *s* is the sheath of the penis which is transparent and poorly chitinized, another characteristic of this family. This sheath is attached at two points to the line *v* connecting the hamules, as well as to the anterior portion of the U-bar where it begins to curve upwards.

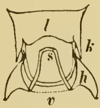

Fig. 21

In Nannothemis, Perithemis and Celithemis these conditions were found to be approximately the same. In the last was found the least chitinized condition of the portion of the framework marked *v* connecting hamules or either side of the sheath. In all other forms examined it was well developed and in some it was very thick and strong. As far as complexity or specialization of parts is concerned, the author concludes that

here we have the least specialized external genital parts, however, all structures here present are found in both suborders and in all are easily homologized with those in Perithemis.

In figure 22 three variations, found in other families of Anisoptera, in the structure of the supporting framework are shown, *x* from Ophiogomphus, *y* from Epiaeschna and *z* from Gomphoides. If one compares these with Perithemis, figure 20, it may be easily seen that all are constructed on the same general form. Ophiogomphus (*x*) shows perhaps the most complex condition owing to the new lines of chitin at *u*. Letter *e* refers to that bar of chitin which is produced under the anterior lamina and passes posteriorly directly under the base of the sheath *s* in each case. The sheath here and in the following figures is much more chitinized and in every way better developed. In Epiaeschna (*y*) the posterior portion of the framework is extremely chitinized and enlarged over that of Perithemis. The hamules are very large with a corresponding enlargement of the framework to which they are attached. The two bars passing on each side of the sheath and below it correspond of course to *e* in (*x*). As far as the support of the sheath is concerned, this seems to represent a transition between (*x*) with the lines at *u* fully developed and (*z*) with the indications of such lines entirely lacking. One can easily note in (*y*) the stumps of processes which are homologous, as far as they go, to lines *u* in (*x*).

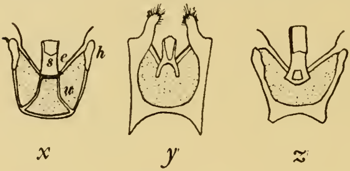

Fig. 22

Perhaps the spatial relations of these complicated parts will be better shown by a diagram of the median plane. Figure 23 presents a sagittal section of the inverted ventral part of the 2d segment in both suborders, with homologies indicated as far as possible. These are views from the interior, (*m*) being the inside view of Zygoptera and (*n*) that of Anisoptera.

In (*m*) the anterior lamina is marked *l*. It passes posteriorly just over the anterior portion of the framework which is just below the penis at *e*. The under side of the lamina is

marked by two peculiar folds, one attached directly to the lobe at *a* and the other forming what appears as a sheath *x* for the penis *p*. Attention was called to this particular structure in figure 18 (*d*). It is suggested that perhaps the large posterior lobe of the lamina indicated at *a* may function as a hamule, like the first pair of hamules present in many of the Anisoptera. Letter *e* shows the anterior portion of the framework which is connected with *v* the posterior portion at *h* or the hamule. The penis is supported directly by *e* and in a position exactly corresponding to the sheath in Anisoptera. Only its base is shown, with the recurved tip cut off. *f* shows a line just back of the hamule *h* apparently separating the hamule and the posterior portion of framework *v* from *e* the anterior portion.

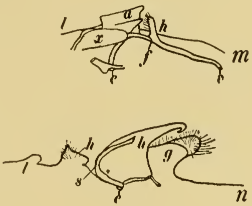

Fig. 23

In (*n*) one may note the condition found in the Anisoptera. The well developed hamule *h* resting on the framework with its prominent hooked end extended posteriorly. The second *h* refers to another structure developing from the anterior lamina *l* and functioning where well developed as the first or anterior pair of hamules. *s* is the sheath for the penis (penis not shown in the figure: it is attached to segment 3 but extends forward well over segment 2.) *g* is a structure peculiar to the Libellulidae, already referred to as the genital lobe and no doubt functioning in copulation.

The greatest difference to be noted in these two figures is in the location of the penis. In Zygoptera we find it on segment 2 and in the exact position occupied by the sheath in Anisoptera.

Let us now turn to the anterior portion of the second abdominal sternite. In figure 24 there are several anterior laminae of Anisoptera, each showing quite clearly that portion of the lamina which the writer holds has developed into the anterior pair of hamules.

In (*a*) the anterior lamina of Didymops is shown. *l* is the lamina, with *h* the highly chitinized first pair of hamules well developed and slightly reflexed on their edges, no doubt a de-

velopment assisting in copulation. They are also well covered with hairs on their interior surfaces.

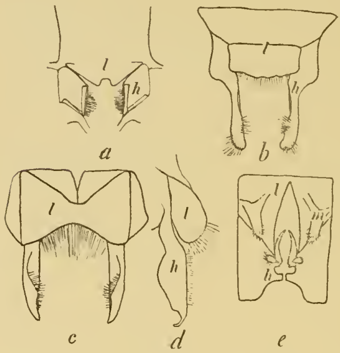

Fig. 24

In (*b*) the very well developed anterior hamules of Gomphoides stigmatus are shown. Here they extend well forward under the sides of the anterior lamina which is indicated at *l*. One should note in this figure how far anteriorly these first hamules pass and that they are an integral part of the anterior lamina.

In (*c*) the lamina and hamules of Gomphidia are shown. These first hamules are thickly chitinized and have a raised edge near the tip, sharp and well covered with hairs. Figure 24 *d* shows a sagittal section of these structures to farther indicate the point of origin of these hamules from the sides of the anterior lamina. *l* here shows the lamina, hairy and chitinized, while *h* is the hamule with its origin well under the lamina.

Figure 24 *e* is one of the most peculiar and highly specialized anterior laminae met by the writer. This was found in Boyeria irene; *h* shows the hamule separated from the lamina *l* by lines which pass just posterior and under the peculiar lobes *m* of the lamina. It is a chitinized structure, specially on its inner side where is formed the peculiar notched edge and the pointed concave structure lying between the posterior portions of the anterior lamina. The lamina itself is almost divided to its anterior end and possesses two well developed fingerlike lobes *m* covered at the ends with hairs. It would be interesting to compare any peculiarities of the female structures that might farther elucidate this peculiar lamina and hamule.

In figure 25 at (*c*) is shown the anterior lamina typical of the suborder Zygoptera. This is a sketch of the lamina of Calopteryx. The lamina is well divided above into two parts marked *o* with their posterior ends *y* lobed and producing on their under surfaces the structures marked *v* and *x*. The latter ex-

tends posteriorly under the lobes *y* and appears at the point marked *w*. This structure lies in Zygoptera in a position exactly corresponding, so far as the penis is concerned, to some of the sheaths of Anisoptera and evidently it has a similar func-

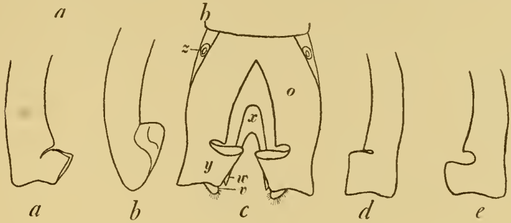

Fig. 25

tion. It is chitinized above and lies over and anterior to the reflexed penis. The posterior lobes of the anterior lamina no doubt function like the first pair of hamules in Anisoptera. *z* shows a pit, a small hole, found in this segment as well as in segments 1 and 3 in a great many instances among both suborders.

Figure 25 *a, b, d* and *e* shows also some of the different lobes of the anterior lamina common to the Zygoptera. (*e*) is from Argia, (*d*) from Nehallennia, (*b*) from Lestes and (*a*) from Anisopleura.

Returning now to the parts developed from the rear of the sternum of the 2d abdominal segment (the sternellum), let us further consider the development of parts immediately adjacent to the penis, the protecting sheath and the hamules. The very remarkable structure of the penis itself has been detailed and figured by Hagen in *Monographie des Gomphines,* and elsewhere. The tips of the hamules have been figured for many forms by many authors, but the forms and relations assumed by the penis sheath have scarcely been noticed hitherto. In figures 26 and 27 are shown two series of forms of the penis sheath, illustrating the comparative development of two different types of sheaths found among the Anisoptera.

Figure 26 *p* is one of the simplest sheaths found. It is a flat, translucent sheath, thin, excepting the edges, lying in a horizontal position below the penis. *x* shows the portion of

the supporting framework heretofore described. This is the sheath of one of the Libellulidae, Nannothemis. *q* and *r* show the same type of sheath a little more chitinized and much more reflexed up and over the penis. *s* is from Didymops and shows a transitional condition between those preceding and those following. Here the sheath is flat but chitinized entirely and reflexed more over the penis. *t* and *u* show the highest specialization of sheaths of this type — thick, chitinized, interior surface flattened, and much reflexed for the reception of the penis. These were found among Aeschnidae. These sheaths of Cordulegaster and Tachopteryx are stiff, hard, black structures. They are supported by the framework the same as that indicated at *x* for Nannothemis.

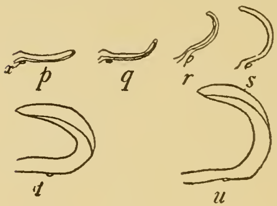

Fig. 26

Figure 27 shows a more highly specialized type than in figure 26. This form of sheath seems to be better fitted to fulfil its function than the former type and in fact each sheath here is a very concave, hollow receptacle for the penis. *p* is the sheath of Gomphus, a very well chitinized structure with a fairly deep cavity for the reception of the penis, indicated by a cross-section of its deepest portion. *x* indicates the position of the underlying framework. *q* is the sheath of Gomphaeschna, one of a slightly different form in that the cross-section of its deepest part presents a wedge-shaped cavity. The other letters *r*, *s* and *t* represent other forms constructed on the same general plan as that of Gomphaeschna.

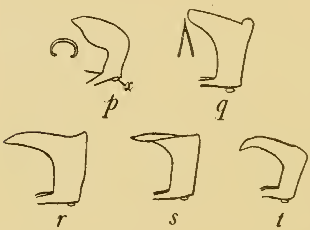

Fig. 27

In figure 28 the relative development of the hamules in the Anisoptera is shown, special attention being called to the development of the first or anterior hamule from the lamina. This is a series beginning with C o r d u l i a s h u r t l e f f i and ending with Ophiogomphus.

In (*k*) is a sagittal section from the 2d segment of Cordulia with the following structures noted, the letters of which indicate the same structures as in the other figures. *e* is a portion of one side of the posterior portion of the framework heretofore described, which is always intimately associated with the posterior hamules. Where the hamules are well chitinized and developed, this part of the frame is correspondingly developed. The hamules appear in some cases to be spread along posteriorly on this framework, adding to its thickness. It can be followed easily in all the figures. *f* is one of the posterior pair of hamules. This hamule in all figures here shown is well developed and in some cases very decidedly hooked at its upper point. *g* is the anterior portion of the framework which passes beneath the anterior lamina where we find but one pair of hamules, and in this figure, and those following, it passes below and posterior to the first pair of hamules derived from the anterior lamina. This portion of the framework is the direct support of the penis in Zygoptera and of the sheath in Anisoptera. *h* is the first pair of hamules developing just before *g* from the posterior edge of the anterior lamina. The lamina is shown at *i* covered with hairs on its posterior and ventral surfaces. The first hamule *h* is not well developed; however, it is so far formed that one can easily homologize it with those more fully developed in any of the following figures.

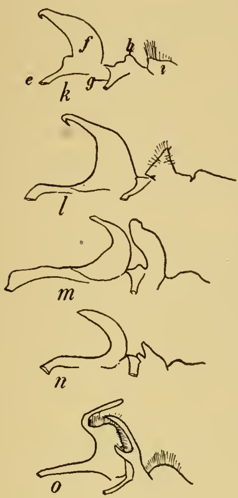

Fig. 28

In (*l*), a sagittal section of Didymops, is shown a farther and decided development of the first hamule marked *h* in the figure above it. The other structures are similarly placed and easily seen to be homologous.

In (*m*) a very marked development of the first hamule is seen, it being, in this case, almost as large as the second hamule. In (*n*), Tachopteryx, is to be noted the beginning of the lobed condition of the first hamule so well shown in (*o*), Ophiogomphus. In other respects, the parts are similar and similarly placed to those of the preceding figures. In (*o*) is presented, perhaps the most extreme development in the way of

hamules. Both the first and the second are remarkably lobed, hairy and chitinized. The first has reached the extreme in regard to its bilobed condition. The second hamule has a sharp, strong prong pointing anteriorly or in the opposite direction to the lobes of the first pair. The anterior lamina is plainly seen anterior to the hamules with the framework in the same position as in other forms.

We may, I think, assume here that these figures represent a developmental series in respect to the production of the first pair of hamules.

Recapitulation of the important points in the foregoing paper:

1 In Anisoptera the penis is found upon the 3d abdominal segment, while in Zygoptera it is found on the 2d. It seems probable that the penis in Zygoptera is developed from the 2d segment, while that in Anisoptera is developed from the 3d and extended upon the 2d. However, evidence from embryology is needed here.

2 The supporting framework in both suborders is built on the same plan.

3 The situation of the posterior or second pair of hamules is homologous in the suborders, as well as the situation of the seminal vesicle.

4 In Zygoptera only one pair, the posterior, of hamules is found unless we assume that the peculiarly developed posterior lobes of the anterior lamina here, are to be taken as hamules.

5 No sheath of the penis is found in Zygoptera homologous in position to that of Anisoptera, but we may assume that the chitinized structure between the posterior lobes of the anterior lamina serves the same function as the sheath in Anisoptera, because of its location before and over the penis.

6 The sheath in Anisoptera and the penis in Zygoptera are in homologous positions, that is, directly upon the anterior portion of the framework which passes across below them.

7 Evidence seems to show that the anterior lamina, first pair of hamules and the anterior portion of the framework, that is, the part extending under, and attached to the lower surface of the anterior lamina, are developments of the sternum, while all other structures on segment 2d come from the sternellum.

8 The Libellulinae among the Anisoptera seem to show the least specialized male genital apparatus, while it is difficult to settle which is so among the Zygoptera. The extreme in specialization of these parts is perhaps found among the Gomphidae.

9 The anterior or first pair of hamules in the phylogenetic series show themselves to be developments of the anterior lamina.

10 Among the Libellulinae two pairs of hamules are not found, but as compensatory organs the genital lobes are very well developed. Genital lobes are not found where the first or anterior pair of hamules is well developed.

11 Among the Anisoptera, the Aeschnidae and the Gomphidae have a very highly specialized condition of the 2d segment while the Libellulidae represent the other extreme. The Cordulegasteridae seem to be transitional in some respects between the two.

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NOTE. Figures of the appendages herein discussed will be found in the systematic papers of Calvert, Förster, Hagen, Kirby, Martin, Needham, Ris, Williamson and other writers on Odonata.

NEW NORTH AMERICAN CHIRONOMIDAE

BY

OSKAR AUGUSTUS JOHANNSEN

Since the publication of the paper on Chironomidae in the New York State Museum Bulletin 86 (Entomology 23), 1905[1] there have appeared several papers on this family of flies in which some changes in classification are proposed, making it desirable to give a review of this work. The most important of these papers is J. J. Kieffer's *Chironomidae* in *Genera Insectorum*, 42me Fascicule, 1906, in which several of the older genera have been subdivided. The necessary changes to bring the key of Bul. 86 (page 89) down to date are given on pages 264 and 270 of this report.

Subfamily CERATOPOGONINAE

Group Ceratopogon, Bul. 86, p. 92, line 25

i Last tarsal joint with empodium, either distinct or developed pulvilliform, wings usually hairy, femora without spines, tarsal claws equal

j Empodium well developed, almost as long as the claws, these without setae . . . .Ceratopogon[2]

jj Empodium not so distinct, less than half as long as the claws, the latter with setae at the base, hind metatarsus always longer than the following joint, wings often spotted or mottled (*Occacta* Poey is probably a synonym) ....Culicoides

ii Last tarsal joint without empodium, wings usually bare

j Wing with R_1 distinctly separated from the posterior branch of the radius and not connected with it by the cross vein like R_{2+3}. Bezzia[3]

jj Wing with R_{2+3} present, crossvein like

k Media simple . . . .Brachypogon

kk Media with two branches

l Femora without stout spines on the underside .... Johanniseniella Williston

ll Some or all femora spinose beneath

m Neither fore nor hind femora much thickened......Palpomyia

mm Either fore or hind femora thickened

n Fore femora thickened ....Heteromyia

nn Hind femora thickened . . . .Serromyia

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[1] All reference to this bulletin will be given in this paper as "Bul. 86."

[2] If the names published in the earliest work of Meigen (1800) are accepted by entomologists then *Tendipes*, *Pelopia*, and *Helia* will replace respectively *Chironomus*, *Tanypus*, and *Ceratopogon*.

[3] The homology of the wing venation is incorrectly given on pl. 17, fig. 13-16, in Bul. 86. What is marked R_{4+5} should be marked M_{1+2}; in fig. 15 R_{2+3} should be marked R_{2+5}; in fig. 16 R_2 should read R_{2+3}, and R_{2+3} should read R_{4+5}.

Species which belong to the Ceratopogoninae but not sufficiently characterized to place are: sordidellus (belongs to Bezzia or Johannseniella), basalis and obscurus (Palpomyia or Bezzia), arcticus and sequax (belong to Ceratopogon or Johannseniella), albarius and dimidiatus (belong to Johannseniella or Palpomyia), rufus and subasper (belong to Palpomyia or Heteromyia), and scutellatus Say (wholly indeterminate). The species stenammatus and wheeleri are known only in the immature stages.

Genus CERATOPOGON

Meigen, 1803; Kieffer, 1899, 1906

Meigen (1803) mentions barbicornis as the representative of this genus. This was evidently an erroneous identification, since in 1804 he placed it among unknown species and gave a compiled description, followed by the remark that he was not certain whether the species described under this name by Gmelin and Schrank was the true barbicornis or whether they had mistaken his Ceratopogon communis for it — thus apparently indicating that he had made the same mistake previously. It thus appears that Meigen had communis in mind as the representative of the genus and it must therefore be considered as the type. I am indebted to Mr Coquillett for the quotation from Meigen (1804).

Ceratopogon communis, though not a well known species, belongs without doubt (as may be seen from Meigen's description) to the genus Ceratopogon as now restricted, under the subgenus Atrichopogon of Kieffer.

The following North American species are referred to the genus Ceratopogon. Those marked with an asterisk may possibly belong to Culicoides. *ancorus, *bellus, bipunctatus, brumalis, *calcaratus, cilipes, *cinctipes, *decor, eques n. sp., eriophorus, exilis, fimbriatus, flavus, fuscicornis, fusculus, *genualis, *hirtulus, *hollensis, *lituratus, monilicornis, *parvus, pergandei, pilosulus, propinquus, *pygmaeus, specularis, squamipes, *tenebrosus, tersites, texanus, *transiens, *unicolor, websteri, peregrinus n. sp., arcticus and sequax. The last two may belong to Johannseniella.

Ceratopogon bipunctatus Linne, which is not

uncommon in New York, resembles s p e c u l a r i s Coq. but differs in having the mesonotum opaque and sparsely beset with yellow hairs.

Ceratopogon eques n. sp.

Female. Head, with face, proboscis, palpi and antennae wholly fuscous; hairs of the head yellowish; those of the antennae grayish white; eyes widely separated, cut out around base of antennae, the latter with basal joints moniliform, first joint enlarged, two to eight shorter than wide, closely sessile, ninth about as long as wide, tenth to thirteenth spindle-shaped, from twice to thrice as long as wide, thirteenth and fourteenth wider than the preceding, fourteenth especially considerably enlarged, its apex with a tiny papilla which is but little longer than wide. Facets of the eyes large. Thorax including pleura, sternum, and metanotum fuscous, subopaque, the scutellum concolored or but little lighter. Hairs of the dorsum pale yellow, a few longer ones over the fore coxae and the setae of the scutellum for the most part black. Abdomen fuscous, subopaque, the hairs paler, except a few long black setae near base.

Legs pale yellow, the apical tarsal joints a little darker; coxae fuscous; hind metatarsus over twice as long as the following joint; fourth tarsal joint slightly shorter than the fifth; empodium brushlike, as long as the claws. Wings covered with grayish hairs, no pale stigma on the costa, the hairs on the posterior margin of moderate length. The radius ends but little beyond the middle of the wing, the anterior branch of this vein ends in the costa about as far proximad from end of the posterior branch as the length of the small cell, which is nearly obliterated; media with short indistinct petiole; cubitus forks at about the mid length of the wing; veins fuscous. Halteres cream-white. Length ¾ mm.

This little fly was taken by Professor Needham in numbers from the wings of Meleoma at Old Forge, N. Y., in the summer of 1905.

Ceratopogon peregrinus n. sp.

Female. Fuscous. Head with the antennae, palpi and the proboscis fuscous; eyes contiguous; antennal hairs yellowish, the structure of the antennae as in C. e q u e s, but the apical papilla over twice as long as wide. Thorax and abdomen wholly fuscous, with yellowish pollen and brown hairs; thorax subshining, abdomen opaque, pollen of the latter not conspicuous. Legs sordidly yellow to yellowish brown, hind metatarsus about three times as long as

the following joint, fourth tarsal joint slightly shorter than the fifth, pulvilli about as long as the claws. Wings hairy on the apical half and on the posterior margin; R_{4+5} ends at .7 the length of the wing, second radial cell about three times as long as the first, both distinct, base of the first radial cell, fork of the media and of the cubitus equidistant from the base of the wing, petiole of the media about half as long as the cross vein. Halteres distinctly pale brown. Length 1 to 1.25 mm. Old Forge, N. Y.

Genus CULICOIDES

Latreille, 1809; Kieffer, 1899, 1906

Oecacta Poey (1851) and Haematomyidium Goeldi (1905) are probable synonyms. The type of the genus is C. punctata Meigen.

It was formerly supposed that all the hairy winged species of the Ceratopogoninae had terrestrial larvae, but this is not the case. Mik some years ago described a semiaquatic larva from which he bred Culicoides hippocastani, and I have reared several species of Culicoides and also of the subgenus Ceratopogon from aquatic larvae which differ but little from those of the bare winged members of this subfamily.

The North American representatives of this genus are: biguttatus, cinctus, cockerelli, griseus, guttipennis, levis, lotus, maculithorax (=Oecacta furens?), melleus, mutabilis, phlebotomus, sanguisuga, scutellatus Meigen, stellifer, and variipennis. Several of the species listed with Ceratopogon may belong to this genus also.

Genus BEZZIA

Kieffer, 1899, 1906

Kieffer gives (Ceratopogon) ornata Meigen as the type of the genus Bezzia.

Subgenera of BEZZIA

a Femora without prominent spines underneath............Probezzia Kieffer
aa Femora with prominent spines underneath...............Bezzia Kieffer

North American species belonging here are as follows: Subgenus Probezzia: albiventris, bivittatus, elegans, elegantula, flavoniger, gibber, glaber, inermis, opacus, pachymerus, smithii, terminalis.

Subgenus Bezzia: barberi, expolitus, johnsoni, medius, pruinosus, pulverus, punctipennis, setipes, setulosus, varicolor, venustulus.

Genus JOHANNSENIELLA

Williston, 1907

Ceratolophus Kieffer is a synonym. Name changed owing to preoccupation.

The type of this genus is nitidus Macquart.

The following species are North American representatives of the genus: antennalis, argentatus, bimaculatus, caudellii, diversus, flaviceps n. sp., gilvus, lacteipennis, longicornis, maculipennis, magnipennis n. sp., magnus, nebulosus, pictus, politus, stigmalis, and viridis.

Johannseniella flaviceps n. sp.

The species described on page 105 (Bul. 86) may be called flaviceps. To the description must be added that the media forks proximad of the R-M cross vein and that all claws are small and equal.

Johannseniella magnipennis n. sp.

Male. Head cinereous, mouth parts and antennae fuscous, the palpi and basal joint of the antenna rather paler. Antennae rather slender, about as long as the thorax, short haired, joints cylindric-oval. Eyes widely separated. Thorax densely covered with a cinereous bloom, covering also the sternum, scutellum and the mesonotum. Pile of the dorsum short, sparse, and pale. Abdomen, which is much shrunken in both specimens, is yellowish brown to brown; genitalia darker, apical lobes yellowish, hairs yellowish.

Legs elongate, brown, including coxae; tarsi white, the apical joint of each foot black; hairs of femora and tibiae sparse, short and pale; fore metatarsus about two thirds as long as its tibia; last tarsal joint with two rows of stout blunt spines on under side, fourth joint slightly broadened, somewhat shorter than the fifth; claws simple, equal, about half the length of the last tarsal joint; tarsi ciliate with fine stiff hairs on the flexor surface. Wings wholly hyaline, including the veins except the cross vein which is brownish; wing extremely long and broad in proportion to size of fly, extending considerably beyond apex of the abdomen, anal angle especially

prominent. Costa almost reaches tip of the wing, the posterior branch of the radius entering the costa but a short distance from its apex. First radial cell about three times as long as wide; the media forks before the R-M cross vein; the cubitus forks more than the length of the first radial cell before the fork of the media, the two anal veins do not reach the wing margin. Halteres with a grayish tinge. Length 2.5 mm (abdomen shrunken). Length of each wing 5 mm. Two specimens. Old Forge, N. Y.

Johanniseniella argentata Loew

This species was erroneously referred to Palpomyia (Sphaeromyas) in Bul. 86.

Genus PALPOMYIA

Megerle in litt. Meigen 1818

The type of the genus is flavipes Meigen (=geniculata Megerle).

Subgenera of PALPOMYIA

a Last tarsal joint with two rows of coarse spines below.......Sphaeromyas
aa Last tarsal joint with hairs below ....Palpomyia

Alasion Rondani must be considered as a synonym of the subgenus Palpomyia since flavipes Meigen (=hortulanus) is given as the type for each.

The following are North American species of this genus. Subgenus Sphaeromyas: longipennis, scaber, schwarzii, slossonae, subasper, tibialis.

Subgenus Palpomyia: curriei, flavipes, lineatus, nubifer, trivialis.

Genus HETEROMYIA

Say, 1824. Restored to generic rank by Kieffer in 1906

The type species is Heteromyia fasciata Say.

North American species are: clavata, fasciata, festivus, plebeius, prattii.

Genus SERROMYIA

Megerle. Meigen, 1818. Restored to generic rank by Kieffer in 1906

S. femorata is the type. It is the only species yet recorded from this country.

Subfamily TANYPINAE

Group Tanypus, Bul. 86, p. 89, line 18 from the bottom

f Wings bare
  g Fork of the cubitus petiolate
    h R_1 apparently forked at its extremity (i. e. R_2+_3 distinct) . . Procladius
    hh R_1 not forked at extremity .... Psilotanypus
  gg Fork of the cubitus slightly proximad of the M-Cu cross vein
    h R_1 with fork at its extremity (i. e. R_{2+3} distinct) .... Anatopynia
    hh R_1 without this fork .... Protanypus
ff Wings pubescent
  g Fork of the cubitus slightly proximad of the cross vein (=Ablabesmyia) Tanypus
  gg Fork of the cubitus petiolate
    h R_1 apparently forked at its extremity (i. e. R_{2+3} distinct) Protenthes [*see* Ent. News, 1907, p. 400]
    hh R_1 not forked . . . . Trichotanypus

Species which belong to this subfamily but not sufficiently characterized to place in the following genera are: bellus and flavicinctus (Procladius or Psilotanypus), humeralis, tricolor and turpis (bare-winged, possibly Anatopynia), tibialis Staeger and pictipennis (hairy-winged, probably Tanypus), baltimoreus and tibialis Say (wholly indeterminate).

Genus PROCLADIUS

Skuse, 1889

The following are North American species: adumbratus, caliginosus, concinnus, pinguis, pusillus, scapularis, thoracius, and nubifer.

Procladius nubifer Coquillett

1905 Tanypus. Coquillett, N. Y. Ent. Soc. Jour. June

Falls in the couplet with occidentalis (2) in the key given in Bul. 86. Distinguished by its spotted wings. It is yellow; the first antennal joint, palpi, three vitae on mesonotum, lower portion of the thorax, the metathorax, and the bases of the abdominal segments brown; legs whitish; wings whitish hyaline with about nine clouds or spots. Length 3 mm. Utah.

Procladius thoracicus Loew

1866 Tanypus. Loew, Berliner Ent. Zeitschrift

I have seen specimens of this species from New Jersey and Louisiana. In the description given in Bul. 86 on page 129, the third line, place a comma after the word "tibia" and strike it out after the word "tarsus."

Genus PSILOTANYPUS

Kieffer, 1906

This genus is represented by occidentalis in our fauna.

Genus ANATOPYNIA

Johannsen, 1905

The type of this genus is (Tanypus) plumipes Fries. The species humeralis and tricolor may belong here.

Genus PROTANYPUS

Kieffer, 1906

Protanypus heteropus Coquillett

1905 Tanypus. Coquillett, N. Y. Ent. Soc. Jour. June

Black; halteres light yellow fourth tarsal joint short and dilated. Length 3 to 4 mm. Wash., N.M., N.H. The only species thus far recorded from this country.

Genus TANYPUS

Meigen, 1803, part; =Ablabesmyia Johannsen, 1905, and Isoplastus Skuse, 1889

Type of the genus is monilis L. All the North American species mentioned by me in Bul. 86 under the name of Ablabesmyia belong here. Besides these sinuosus, tenebrosus and miripes (Coquillett, 1905), aureus Johan. (1907) and florens n. sp. are members of the genus.

The following key contains the varieties of the carneus-ornatus group together with the North American species not included in the table on Ablabesmyia given in Bul. 86. In a large series of specimens of the carneus-ornatus group [nos. 1–8] it was found that they exhibit such intergradation that it is difficult to define the specific limitations. They differ in the amount and intensity of coloration of body, wings and legs to such a degree that scarcely two specimens can be found that are alike in every particular.

a Prevailing color of either thorax or abdomen or both, pale
  b Thorax dull black; abdomen golden yellow........aureus Johan. '07
  bb Thorax yellowish
    c Legs unbanded (carneus group)
      d Thoracic stripes not margined with black
        e Cross vein without cloud ....var. 1. carneus (Schiner)
        ee Cross vein with cloud
          f Fourth tarsal joint about two thirds of third .... var. 2. carneus (Zetterstedt)

ff Fourth tarsal joint about one half of third in length ....
m i r i p e s Coq. '05
dd Thoracic stripes margined with black
e Cross vein with cloud ....var. 3. s i n u o s u s Coq. '05
ee Cross vein without cloud ....var. 4
cc Legs banded (ornatus group)
d Thoracic stripes not margined with black
e Cross vein with dark cloud ....var. 5
ee Cross vein without dark cloud ....var. 6. j o h n s o n i
dd Thoracic stripes margined with black
e Cross vein with cloud.............var. 7. o r n a t u s (Schiner)
ee Cross vein without dark cloud ....var. 8
aa Prevailing color of body dusky
b R_{2+3} present at apex of R_1, posterior margins of abdominal segments yellow; cross vein not distinctly clouded ....f l o r e n s n. sp.
bb R_{2+3} absent ....t e n e b r o s u s Coq. '05 and arietinus Coq. '08

Tanypus florens n. sp.

Male. Resembles f a s t u o s u s but differs in being smaller, more slender, in having no black cloud on the cross vein and in having the posterior margins of the abdominal segments conspicuously yellow.

Head, with mouth parts and antennae dark brown. Thorax brown, sternum, metanotum and thoracic stripes somewhat cinereous, narrow spaces between the stripes with rows of yellow hairs upon them. Other shorter hairs on the dorsum also yellow; scutellum pale brown. Abdomen brown, apical ¼ or ⅓ of each segment yellow, pale coloring more conspicuous on the sides, hairs yellow. Genitalia dark brown, basal joint of each limb of forceps ovate, its greatest diameter about ½ the width of the last abdominal segment, apical joint slender, not as long as the basal joint, curved clawlike, and sharply pointed. Legs yellow with yellow hairs, apex of each femur and base of each tibia brown, the articulation at the knee yellow; tarsi somewhat more dusky. Fore metatarsus about .6 as long as the tibia. Wings hairy, cubitus forks slightly proximad of the cross vein, surface brownish hyaline, when held obliquely appears iridescent along the veins, giving the wing a mottled appearance; hairs yellowish brown; cross vein slightly darker than the adjacent veins but not covered by a dark cloud; anterior cross vein quite oblique and longer than the posterior cross vein; R_{2+3} near apex of R_1, pale yellow; halteres yellow. Length 2.5 mm. Ithaca, N.Y.; Boulder and Florissant, Col., and Washington state.

Genus PROTENTHES

Johannsen, Ent. News, 1907; = Tanypus Johannsen, Bul. 86

The type of this genus is cinctus (= punctipennis Meigen). To this genus belong all species which I described under Tanypus in Bul. 86, with the exception of T. posticalis Lundbeck. The following new species will find a place in the key given in Bul. 86 with stellatus, from which it differs in its wing markings and leg coloration.

Protenthes pulcher n. sp.

Female. Head, including proboscis, and basal joint of the antennae cream-white, the flagellum pale fuscous, thirteenth and fourteenth antennal joints somewhat enlarged, fifteenth joint dark brown at tip; labrum and palpi fuscous; occiput white with a brown spot back of each eye; eyes black, deeply emarginate. Thorax cream-white, the median stripe brown, blackish anteriorly, divided, posterior border emarginate, lateral stripes deep brown, produced backwards to the scutellum, scutellum white, scutellar suture narrowly brown; metanotum and sternum brown; pleura with brown spots as follows: a pear-shaped spot on each side of sternum separated from the brown of the sternum by a narrow white line, a triangular spot cephalad of this, and three small ones near base of wing. Abdomen wanting. Legs white, the tips of all femora, tibiae and metatarsi widely dark brown, second joint of all tarsi wholly white, third, fourth and fifth joints wholly brown, fourth joint linear. Wings thickly hairy, with a brown spot covering the cross veins, a broad fascia extending from apex of R_1 to the posterior margin of the wing, the band widening wherever it is crossed by a vein and constricted again behind it, a subtriangular spot near the posterior margin behind the cross veins, and a small one on the anal lobe. Venation like that of P. culiciformis but the media slightly more curved down at the extremity [Bul. 86, pl. 27, fig. 15]. Halteres pale. Length about 2½ to 3 mm. Old Forge, N. Y.

Genus TRICHOTANYPUS

Kieffer, 1906

T. posticalis Lundbeck is the only representative of the genus. The absence of the vein R_{2+3} and the retracted position of the M-Cu cross vein are the distinctive generic characters. I have a specimen of this species from Ithaca, N. Y.

Subfamily CHIRONOMINAE

Genus CORYNONEURA

Winnertz, 1846

Numerous specimens of C. atra (=celeripes) were seen in July hovering beneath the shrubbery which overhangs a little brook near Ithaca, N. Y. The figure given by Winnertz of the wing [reproduced in Bul. 86, pl. 36, fig. 7] is not strictly correct. The anterior veins though stout do not wholly obliterate the cell between them. Only when held obliquely does the wing appear as shown in the figure. The larva is described by Thienemann ('08).

Genus CHASMATONOTUS

Loew, 1864

Key of species

a Yellowish species; abdomen dark brown, wings grayish hyaline, somewhat smoky in front of the radius. California..hyalinus Coq. (1905)

aa Dusky species

b Wing with two prominent white spots, apex black [Bul. 86, pl. 27, fig. 16] bimaculatus Loew

bb Wing not marked in this way

c Wing with two white spots and a very narrow apical margin, whitish hyaline. British Columbia ....fascipennis Coq. (1905)

cc Wing with fewer spots

d Wing with longitudinal vitta between the media and the cubitus; abdomen with posterior margins of the segments whitish. Alaska. univittatus

dd Wing with a broad white transverse fascia. N. Y............... unimaculatus

NOTE. Bul. 86, on page 167, line 10, for maculatus read bimaculatus.

Genus HYDROBAENUS

Fries, 1830

Both larvae and adults have recently been described by Giard (1904). According to this author the male has but 12 antennal joints and not 14 as given by the earlier authors. The genus has not yet been found in North America.

Genus PRODIAMESA

Kieffer, 1906

This genus is distinguished from Diamesa in having a linear fourth tarsal joint, longer than the fifth. A specimen of Prodiamesa

(probably P. notata Staeger '39) was sent to me by Professor Cockerell from Boulder, Colorado. This is the only species yet recorded of the genus from this continent.

NOTE. Bul. 86, page 178, line 5 from the bottom, for plate 36 read 30.

Genus THALASSOMYIA

Schiner, 1856

Compare Scopelodromus, Bul. 86, page 307. See also an article by Chevrel in Arch. de Zool. Exp. et Gen. Ser. 4. 2. page XXIX in which the author admits the possible identity of the two genera.

Key of North American species

a Yellow species, thorax with ochraceous median vitta......fulva n. sp.
aa Dusky species
  b Dorsum of thorax blackish, with indications of three stripes, covered with silvery bloom, most conspicuous on the humeri. N. Y..obscura
  bb Thorax black, humeral spot yellow; length 2.5 mm. Arizona.platypus

Thalassomyia fulva n. sp.

Male. Head yellow, rostrum at tip and the basal joint of the antennae ochraceous; palpi fuscous, slender, basal joint but little longer than wide, second twice, third thrice, and fourth four times as long as the first, the last joint quite slender; antennae and antennal hairs sordidly yellow, 14 jointed, last joint elongate as in Chironomus, eyes bare. Thorax clear yellow, the sternum, metanotum, and the three thoracic stripes ochraceous, anterior lateral margins of the scutellum with dark brown spots which are continued in a fine line mesad in the scutellar suture. Abdomen sordidly yellow, the anterior part of each segment paler. Genitalia resemble those of T. obscura but apical joint rather longer and blunt at the end. Thoracic and abdominal hairs yellow, thoracic setae sordidly yellow. Legs yellow, tarsi somewhat infuscated, fourth joint less than half as long as the last joint. Fore legs wanting in the single specimen. Claws simple, empodium and pulvilli inconspicuous; two short black spurs at apex of each tibia. Wings hyaline, whitish tinged, veins including cross vein yellow, cubitus forks distad of the cross vein, costa produced slightly beyond tip of the vein R_{4+5}. Halteres yellow. Length 3.5 mm. Old Forge, N. Y.

NOTE. The name Thalassomyia fusca which appears on pages 174, 225, 271, 307, 308, 326, of Bul. 86 should read Thalassomyia obscura, as both names refer to the same species.

Genus CHIRONOMUS

Meigen, 1803

The following table contains North American species which are not included in the key given in Bul. 86, and in addition tabulates the males of those species which are characterized by their dusky thorax and abdomen (the thorax sometimes having yellow humeri and faint indications of paler division lines upon the dorsum, the segments of the abdomen sometimes with gray or yellowish posterior margins; legs nearly unicolored, yellowish to blackish).

a Wings with several spots or bars
  b Wings with several spots
    c Tibiae each with two distinct white bands.....naevus Mitchell '08
    cc Tibiae without distinct white bands
      d Length 2 mm. or less
        e Wings with several spots, one at the cross vein.................. labeculosus Mitchell '08
        ee Spot distad of cross vein, halteres pale, foremetatarsus 1¾ times as long as the tibia ....needhamii n. sp.
      dd Length over 2.5 mm., halteres with dusky tip, foremetatarsus nearly 1½ times as long as the tibia...............nubeculosus
  bb Wings with fasciae or bars
    c Wing with two complete brown bars, the distal one mottled with clear spots ....perpulcher Mitchell '08
    cc No clear spots on bars
      d Legs nearly wholly whitish, knees slightly brownish, less than one fourth of tibia brownish
        e Wing without black apical band.....calopterus Mitchell '08
        ee Wing with wide apical band.........zonopterus Mitchell '08
      dd Apex of each femur and basal fourth (or more) of each tibia, blackish
        e The dark band at apex of wing measured along R_{2+5} less than half as wide as the white band which precedes it.............. poecilopterus Mitchell, '08
        ee The width of the apical band nearly equal or greater than the white band which precedes it
          f Entire fore and hind tibiae dark..nephopterus Mitchell, '08
          ff Fore tibiae not wholly dark
            g Apical half of hind tibiae white................pulchripennis
            gg Apex of hind tibiae dusky
              h Middle section of hind tibiae white...................... exquisitus Mitchell, '08
              hh Middle section of hind tibiae not pure white .... taeniapennis
aa Wings unspotted, sometimes with darkened cross vein
  b Thoracic stripes gray or blackish, or thorax wholly dull black; abdomen mainly black

c Wings smoky, especially along the course of the veins, veins reddish brown, including the cross vein, end of knob of the halteres brown; (new name for c a l i g i n o s u s, which is preoccupied for fossil species) ....i t h a c a n e n s i s new name

cc Wings hyaline, with brown cross vein

d Forestarsi of the male bearded

e Foremetatarsus not over 1¼ times the tibia in length

f Abdominal segments black, posterior margins sometimes gray, not yellow

g Foremetatarsus 1⅛ times the tibia in length, abdominal segments with faintly grayish margins......n i v e i p e n n i s

gg Foremetatarsus 1 1/5 or more times the tibia in length

h Legs black, fourth tarsal joint of foreleg about ¾ the length of the third (legs fuscous; var. meridionalis).......... h y p e r b o r e u s

hh Legs subfuscous, third and fourth tarsal joints subequal in length ....a n n u l a r i s

ff Abdominal segments with yellowish posterior margins

g Ground color of the thorax gray, stripes blackish, humeri yellowish, large species 9 to 12 mm in length..p l u m o s u s

gg Ground color of the thorax more yellowish, smaller species 7.5 to 9 mm in length ....p r a s i n u s

ee Foremetatarsus over 1⅓ times the tibia in length

f Halteres yellow............................m a t u r u s n. sp.

ff Halteres dusky, third and fourth tarsal joints of the forelegs subequal in length........ ....a t t e n u a t u s

dd Foretarsi of the male not bearded

e Male claspers unusually stout, foremetatarsus 1¼ times the tibia in length; abdominal segments gray, margined with yellow; legs yellowish..........................

ee Male claspers slender

f Foremetatarsus about 1¼ times the tibia in length; black species, legs blackish, abdominal segments with cinereous margins... s t a e g e r i

ff Foremetatarsus over 1⅓ times the tibia in length

g Thoracic stripes black divided by gray lines, humeri sometimes yellow; abdominal segments black, posterior margins gray; foremetatarsus 1½ times the tibia in length........ r i p a r i u s

gg Not as above in all particulars

h Small species, 3 to 4 mm in length; foremetatarsus over 1⅔ times the tibia in length..................s i m i l i s

hh Species 5 mm or more in length

i Middle and hind femora each with broad yellow band before apex ....c o m p e s Coq. '08

ii Legs not so marked

j With foremetatarsus about 1½ times the tibia in length; 6.5 to 8 mm in length ....c r i s t a t u s

jj With foremetatarsus about 1.6 times the tibia in length; length 6 mm.........................r e d e u n s ?

bb Pale species
c Forem etatarsus over 1¾ times as long as the tibia
d Legs brown, tarsi conspicuously white; length 4 to 5 mm........ hirtipes Mitchell '08
dd Legs yellow; length 2.5 to 3 mm........flaviventris Johan.
cc Foremetatarsus less than 1½ times the tibia in length
d Thorax with three blackish stripes, abdomen of female yellow, of male green.............................lucifer Johan. (1907)
dd Thoracic stripes paler
e Length 5 mm., abdomen yellow, legs with brown bands.......... fascipes Coq. '08
ee Length 6 to 7 mm
f Body reddish brown, abdomen dark brown........albistria
ff Thorax with three testaceous stripes, abdomen green, foretarsi of the male hairy ....stylifera n. sp.

Chironomus needhamii n. sp.

The species described by me under the name of scalaenus on page 201 of Bul. 86 should be considered as a distinct species, differing from the European form in size, coloring, and particularly in the metatarsal proportions. Named in honor of Prof. J. G. Needham. I have seen specimens from New York, Indiana, Kansas, and Washington.

Chironomus nubeculosus Meigen

1818 Chironomus. Meigen. Syst. Beschr. I. 37, 37
1864 Chironomus. Schiner. Fauna Austr. II. 598

Male. Head, with its mouth parts, thorax and abdomen wholly blackish, antennae and the hairs brownish, dorsum of the thorax appears pollinose; when held obliquely abdominal segments with only faint indications of cinereous posterior margins. Thoracic, abdominal and leg hairs yellowish brown; genitalia slender. Femora brownish, tibiae and tarsi yellowish brown; foretarsi not bearded, forem etatarsus over one third longer than the tibia; pulvilli prominent. Wings hyaline, with grayish spots; one at the junction of radius and media, one in the fork of the cubitus, one at the tip of Cu_2 and one or two in the anal cell. Cubitus forks slightly distad of the cross vein. When held obliquely the wing spots appear iridescent. Halteres with blackish tip. Length 2.5 to 4 mm.

Female. Like the male but the wings are broader and in one specimen the wing spots are subobsolete. Florissant, Col.; Ithaca, N. Y.; Pennsylvania.

I have had no European specimens for comparison, but Schiner's and Zetterstedt's descriptions fit my specimens perfectly.

Chironomus ithacanensis new name

A new name for *C. caliginosus* Johan.; *caliginosus* is preoccupied for a fossil species.

Chironomus maturus n. sp.

Male. The front, outer eye margin, two rather slender frontal tubercles, pale yellow; antennae dark brown, hairs pale brown; face, proboscis and palpi subfuscous, basal joint of the antennae gray pollinose. Thorax gray with three blackish stripes, humeri yellowish, scutellum subfuscous, thorax wholly covered with a grayish bloom. Abdomen dark brown, apical one fourth of each segment yellow, which appears silvery when viewed from behind; posterior segments and genitalia nearly wholly grayish, the latter slender, resembling those of *C. decorus*. Legs brownish yellow, the base of each femur, the knees, the fore tibiae and tarsi more brownish, coxae gray, trochanters yellow, pulvilli brushlike, empodium pectinate, anterior tarsi sparsely but long haired, fore-metatarsus about one third longer than the tibia. Wings hyaline, anterior veins yellowish brown, cross vein dark brown, cubitus forks under the cross vein. Halteres yellowish. Length 7 to 8 mm.

Female. Like the male but with broader wings and with slightly longer (proportionally) metatarsus. Ithaca, N. Y. Early spring species.

Chironomus redeuns Walker

Specimens from Ithaca, N. Y., Illinois, and Boulder, Col., appear to be this species. The species resembles *cristatus* and *riparius*, but is smaller than either, and the foremetatarsus is nearly or quite 1.6 times the tibia in length, foretarsi bare; in coloring it resembles *riparius*.

Chironomus barbipes Staeger

A male and female specimen from Harrisburg, Pa. It has previously been recorded from Chicago.

Chironomus devinctus Say

The foretarsi of the male are bare. From Old Forge, N. Y.

Chironomus nephoterus Mitchell, '08

The foretarsi of the male without long hairs. From Old Forge, N. Y.

Chironomus brachialis Coquillett

This species varies greatly in the extent of coloring of wings and legs. From Old Forge, N. Y.

Chironomus frequens Johannsen

The foretarsi of the male sparsely bearded. From Old Forge, N. Y.

Chironomus lineatus Say

In this species the radius, particularly the basal section, and the cross vein are more deeply yellow tinted than the other veins, though the latter can not be called clouded. The foremetatarsus is over one third longer than the tibia. The black longitudinal line on the center of the median thoracic stripe is conspicuous. From Old Forge, N. Y.

Chironomus hirtipes Mitchell (1908)

Female. Head yellowish, vertex yellowish to brownish, eye margin and occiput paler, the latter with yellowish brown hairs projecting forward overhanging the vertex; antennae, including the hairs and the basal joint yellow; proboscis and palpi brown. Thorax pale yellow, in certain lights with a whitish sheen, especially conspicuous on the humeri; dorsum with three pale brownish longitudinal stripes, the middle one divided; some tiny black specks and streaks upon the lateral margin of the dorsal stripe in one specimen; pleura with a black spot over each coxa, the anterior one largest; sternum brown; scutellum yellow, brownish along the anterior margin, metanotum yellow with a brown anterior margin which is divided by a yellow median line. Abdomen brown, the segments with broad whitish posterior fasciae; abdominal hairs dense and long, those on basal half of the segment are brown tipped with yellow, those on the apical half are wholly yellow. Coxae, trochanters, femora and tibiae brown, tarsi conspicuously white, knees of middle and hind legs yellow. Hairs on legs dense, brown in color, except on the tarsi where they are short, sparse and white. Femora and tibiae unusually stout; pulvilli and empodium well developed; foremetatarsus nearly twice as long as the tibia. Wings somewhat smoky, veins brown, base of the wing and also base of the veins

to a little beyond the lobe yellowish; cross vein no darker than the adjacent veins; cubitus forks distad of the cross vein. Halteres yellow. Length 4 mm. Two female specimens from Old Forge, N. Y., taken July 8, 1905.

Chironomus albistria Walker

A reddish brown species of medium size. The whitish side stripes mentioned by Walker are due to pollen and are best seen when the specimen is held obliquely; usually more or less rubbed in captured specimens. The foremetatarsus is about an eighth longer than the tibia in female specimens. Specimens from Old Forge, N. Y., Illinois, and Pennsylvania.

Chironomus stylifera n. sp.

Male. Head sordidly yellow, palpi and proboscis pale fuscous, basal joint of the antennae testaceous, flagellum and its hairs brown. Thorax yellow with a slight greenish tinge; sternum and the three thoracic stripes testaceous; metanotum brown, with the anterior margin yellow. Abdomen uniformly green, pale brown toward the apical end. Genitalia brown, dorsal keel nearly straight, very slender, styliform, lateral lobes stout, shaped like a pistol handle, superior and inferior lobes much retracted and inconspicuous. Forelegs brown, basal two thirds of femur, and of metatarsus, and middle section of tibia somewhat paler brown; tarsi hairy; foretarsi bearded; middle and hind legs yellow, hairy, tips of tibiae brown, tarsi except the basal section of the metatarsi, infuscated; foremetatarsus one fourth longer than the tibia; pulvilli nearly as long as the claws. Wings hyaline, anterior veins yellowish, the cross vein but little darker; cubitus forks under the cross vein. Halteres yellow. Length 6.5 mm. Ithaca, N. Y.

Chironomus lugens Kieffer

A new name proposed by Kieffer (1906) for C. l u g u b r i s Williston, which is preoccupied.

Chironomus leptopus Kieffer

Proposed by Kieffer (1906) for C. l o n g i m a n u s Williston, preoccupied.

Chironomus connexus Kieffer

Proposed by Kieffer (1906) for C. c o n f i n i s Walker, preoccupied.

Genus CAMPTOCLADIUS

Van der Wulp, 1874

Camptocladius aterimus Meigen

A male specimen of this species was bred from the earth taken from the base of some decaying mushrooms, October, 1907.

Genus ORTHOCLADIUS

Van der Wulp, 1874

Subgenera

a Eyes hairy
  b Palpi 4 jointed ....Trichocladius Kieffer
  bb Palpi 3 jointed ....Diplocladius Kieffer, '08
aa Eyes bare
  b Pulvilli large, empodium long and filiform.......Psectrocladius Kieffer
  bb Pulvilli wanting
    c Empodium filiform
      d Palpi 4 jointed ....Dactylocladius Kieffer
      dd Palpi 3 jointed ....Trissocladius Kieffer, '08
    cc Empodium not distinct ....Orthocladius

Trichocladius lacteipennis n. sp.

Female. Head yellow, vertical triangle and rostrum blackish, eyes hairy, hairs visible with an amplification of 20 diameters, distance between the eyes greater than twice the diameter of either eye when viewed directly from in front; antennae dusky yellow, basal joint and apex somewhat darker. Palpi not visible in either specimen. Collar yellow, prominent, incised at the dorso-anterior margin; mesonotum yellow, with three dark brown stripes, the laterals very slender, the median broader and widened out club-shaped along the anterior margin; scutellum, pleura and sternum yellow slightly infuscated, metanotum brownish to blackish, pleura with a black spot in front of the halteres. Abdomen reddish brown, more brownish on dorsum especially on the basal segments. Legs pale yellow, extreme tips of the tibiae and the tarsal joints wholly, more or less infuscated; foremetatarsus about .6 as long as the tibia; claws prominent, pulvilli conspicuous, nearly as long as the claws, empodium pectinate. Wings hyaline, tinged with milky white, broad, anal angle prominent, veins pale, anterior veins as far as the cross vein more yellowish; costa extends beyond R_{4+5} one third of the way to the tip of the media; cubitus forks distad of the cross vein. Halteres yellow. Length 4 mm. Pennsylvania.

Trichocladius politus Coquillett?

Some male and female specimens which may be the above species, agreeing with Mr Coquillett's description, possess also the following characteristics. Eyes hairy, collar not incised on the dorso-anterior margin; abdomen black with a greenish tinge, venter more greenish. Costa produced beyond the tip of R_{4+5} over half the length of the cross vein. Pennsylvania.

Psectrocladius aureus n. sp.

Female. Head and mouth parts fuscous, proboscis black, eyes bare, palpi much longer than the antennae, basal joint short, second and third stout, apical joint slender; antennae dusky. Collar deeply incised on dorso-anterior margin, each side of incision with toothlike projection; thorax dusky yellow, median stripe wide, black; laterals narrow, brown; metanotum and pleura brown, scutellum yellow. Abdomen wholly golden yellow. Legs yellow, tarsal joints slightly darker; foremetatarsus about .9 the length of the tibia; empodium filiform, sparsely plumose, pulvilli brushlike. Wings hyaline not punctate (under amplification of 75 diameters); costa very slightly produced beyond the radius, cubitus forks slightly beyond the cross vein. Halteres pale yellow. Length 2.5 mm. Kansas.

Orthocladius sordidellus

The species from North America under this name are probably not this species at all, as may be seen by comparing the description of the early stages given by me in Bul. 86 with that of Thienemann (1906). There seem to be several closely allied species which differ but slightly. To properly describe and distinguish these would require more material than I have at present at my disposal.

Genus METRIOCNEMUS

Van der Wulp, 1874. Synonym Wulpiella Kieffer

Metriocnemus exagitans Johannsen

In this species the vein R_{4+5} ends some distance from the tip of the wing and not "nearly to the tip of the wing" as stated in the description in Bul. 86. I have seen specimens of this species from New York, Kansas, and Colorado.

Metriocnemus par Johannsen

A female specimen from New Jersey has large abdominal spots and dusky thoracic stripes. Some female specimens from Old

Forge, N. Y., and from the Rocky mountains have dark brown thoracic stripes and the abdominal spots are nearly confluent on the dorsum.

Metriocnemus knabi Coquillett

In the description of the species given on page 306 of Bul. 86, line 9 from the bottom for "laterals" read "peripherals" and for "peripherals" read "centrals."

Genus TANYTARSUS

It is interesting to note that Ulmer (1903) and Lauterborn (1905) describe fibrous larval cases for European species similar to those figured by me on plate 26, figure 9, of Bul. 86, for T. exiguus.

Chironomidae taken at Old Forge, N. Y., by Professor Needham during the summer of 1905

All the species were taken at light; those marked "tent" were also taken in the "water tent" described by Professor Needham on page 167 of this bulletin.

Ceratopogon eques *n. sp.*
C. peregrinus *n. sp.* (tent)
Johannseniella magnipennis *n. sp.*
Procladius bellus (tent)
Tanypus monilis
T. indecisus
T. hirtipennis (tent)
T. ornatus (tent)
T. carneus (tent)
T. johnsoni (tent)
Protenthes culiciformis
P. pulcher *n. sp.*
Corynoneura atra
Thalassomyia obscura (tent)
T. fulva *n. sp.*
Chironomus needhamii *n. sp.*
C. nephoterus
C. brachialis (tent)
C. hyperboreus *new, var.* meridionalis
C. tenellus
C. devinctus
C. nigricans (tent)
C. modestus
C. dorsalis
C. similis (tent)
C. albimanus
C. lineatus
C. frequens
C. albistria
C. hirtipes
Cricotopus trifasciatus
C. bicinctus
Camptocladius fumosus (tent)
Orthocladius sordens
O. sordidellus (tent)
Metriocnemus par
M. atratulus (tent)
M. flavifrons (tent)
M. lundbeckii
M. debilipennis
Tanytarsus pusio
T. obediens
T. exiguus
T. fulvescens

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Appendix D

NEW SPECIES OF CECIDOMYIIDAE II

Miastor americana n. sp.

Female. Length 2.5 mm. Antennae extending to the base of the coxae, sparsely haired, brown, 12 segments. Mesonotum dark brown. Scutellum reddish brown, postscutellum fuscous yellowish. Abdomen pale salmon, fuscous basally, yellowish apically. Legs a nearly uniform yellowish brown.

Taken at Highland, N. Y. June 18, 1907, presumably occurring on either beech or chestnut leaves.

Type C. 1211, N. Y. State Museum.

Oligarces noveboracensis n. sp.

Female. Length 1 mm. Antennae extending to the second abdominal segment, pale yellowish, 13 segments; eyes small, brown, ocelli absent, face yellowish. Mesonotum light brown, pleurae pale orange. Scutellum and postscutellum light fuscous yellowish. Abdomen pale yellowish, the basal and distal segments pale orange, the ovipositor whitish. Halteres yellowish transparent. Legs short, about three fourths the length of the body, a nearly uniform pale yellowish white.

Taken on office window, July 15, 1907, and presumably bred from some material brought into the office.

Type C. 1226, N. Y. State Museum.

Brachyneura americana n. sp.

Female. Length 1 mm. Antennae extending to the base of the abdomen, thickly clothed with narrow scales, black, 12 segments. Mesonotum very dark brown, sparsely ornamented with yellowish hairs. Scutellum black with yellowish hairs basally, postscutellum and abdomen dark brownish black. Wings subhyaline. Halteres fuscous yellowish basally, black apically. Legs mostly a uniform fuscous or black, the second and third segments of the posterior tarsi fuscous yellowish..

Taken August 2, 1906, on a window and presumably bred from some material brought into the office.

Type C. 734, N. Y. State Museum.

Lasioptera eupatoriflorae n. sp.

Male. Length 1.25 mm. Antennae not extending to the base of the abdomen, sparsely haired, dark brown, the basal segments pale reddish, 12 segments; face pale reddish. Pronotum fuscous, mesonotum slightly fuscous, the submedian lines indistinct. Scutellum and postscutellum reddish. Abdomen reddish. Halteres and coxae pale reddish, femora yellowish at the base, brownish apically, tibiae and tarsi brownish.

Female. Length 1.5 mm. Antennae hardly extending to the base of the abdomen, 11 segments. Color characters about as in the male.

Bred August 24, 1907, from flowers of thoroughwort taken at Karner, N. Y.

Type C. a1689, N. Y. State Museum.

Lasioptera excavata n. sp

Female. Length 1 mm. Antennae extending to the fourth abdominal segment, rather thickly haired, black, the basal segments yellowish, 26 segments; face with a conspicuous patch of silvery white scales, the head thickly clothed posteriorly with silvery white scales. Mesonotum narrowly dark brown, broadly and variably margined laterally and anteriorly with pale yellowish, the submedian lines broad, pale yellowish and sparsely haired. Scutellum pale yellowish, postscutellum pale orange. Abdomen mostly pale orange, the second to sixth segments variably marked basally with dark brown, the markings being almost obsolete on the second, nearly reaching the margin on the third and extending thereto on the fourth, fifth and sixth segments; ovipositor pale orange, venter pale yellowish, sparsely clothed with silvery scales. Halteres pale yellowish. Coxae, femora and tibiae mostly pale yellowish, the femora narrowly reddish brown apically, the tarsi black.

Bred August 6, 1907, from a pale green, reddish brown blister-like mine on Crataegus foliage.

Type C. a1576, N. Y. State Museum.

Choristoneura clematidis n. sp.

Female. Length 1.5 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, 26 segments; face below the antennae rather thickly clothed with silvery white scales. Mesonotum dark brown, apparently margined

laterally and anteriorly with silvery white scales, the submedian lines sparsely haired. Scutellum and postscutellum dark brown. Abdomen dark brown, the dorsum of the first abdominal segment thickly clothed with silvery white scales, the second, third and fourth abdominal segments narrowly margined posteriorly with silvery white markings, the latter obsolete laterally. Halteres yellowish basally, whitish apically. Coxae and extremities of femora and tibiae broadly and variably yellowish, the middle dark brown, tarsi dark brown, the distal segments yellowish, the latter possibly denuded.

Taken July 18, 1907, ovipositing in the stem of Clematis virginiana.

Type C. a1596a, N. Y. State Museum.

Choristoneura helena n. sp.

Female. Length 2 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, brown; 18 segments, the two basal segments fuscous yellowish; face with a white patch of silvery scales, the head posteriorly narrowly margined with silvery white hairs. Mesonotum black, sparsely margined laterally with silvery white. Scutellum nearly concolorous. Abdomen black, the incisures dark reddish, each segment sparsely margined posteriorly with silvery white, the venter a uniform silvery gray. Halteres pale yellowish. Legs black with the coxae, the extreme base of the femora and the articulations of the tibiae more or less pale.

Bred July 1907, from round blister galls on Aster lateriflorus taken at Highland, N. Y.

Type C. a1550, N. Y. State Museum.

Choristoneura helianthi n. sp.

Female. Length 2.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, the proximal segments, venter and face silvery white, 18 segments. Mesonotum dark brown, mostly denuded, the submedian lines dark. Scutellum ornamented with numerous silvery hairs, postscutellum with lateral silvery hairs. Abdomen black, the segments narrowly margined posteriorly with silvery white, the latter interrupted at the middle, venter silvery white. Halteres fuscous, pale basally, fuscous apically. Coxae black with silvery hairs, anterior and mid femora gray to the apical third, the posterior

lighter at the base, all black distally with the incisures clothed with silvery scales, tibiae black with the articulations clothed with silvery scales, tarsi black, gray ventrally.

Bred September 3, 1907, from flower heads or leaves of Helianthus strumosus taken at Highland, N. Y.

Type C. a1718x, N. Y. State Museum.

Arnoldia absobrina n. sp.

Male. Length 1.25 mm. Antennae nearly as long as the body, rather thickly haired, dark brown, 12 segments. Head, mesonotum, abdomen, coxae and pleurae all reddish yellow, the mesonotum with the sublateral area slightly brownish, the abdomen sparsely clothed dorsally with fuscous hairs. Halteres yellowish transparent, fuscous subapically. Legs with the coxae and femora pale yellowish, the latter becoming darker distally; tibiae and tarsi dark brown.

Female. Length 1 mm. Antennae extending to the third abdominal segment, sparsely haired, dark brown, 12 segments, the basal segment and face yellowish. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum pale orange, postscutellum pale yellowish. Abdomen rather thickly clothed with fuscous hairs, pale yellowish. Halteres yellowish basally, fuscous apically. Coxae and femora fuscous yellowish, tibiae and tarsi dark brown.

Bred from a jar containing Crataegus leaves bearing a subcylindric fimbriate unicellular gall.

Type C. a1555x, N. Y. State Museum.

Arnoldia fraxinifolia n. sp.

Male. Length 1 mm. Antennae about as long as the body, rather sparsely haired, dark brown, the basal segments yellowish, 12 segments; face fuscous yellowish. Mesonotum light brown, the submedian lines indistinct. Scutellum, postscutellum and abdomen a nearly uniform light yellowish or yellowish orange, the latter sparsely clothed dorsally with fuscous hairs, genitalia light fuscous. Halteres yellowish basally, light fuscous apically. Coxae and femora pale yellowish, tibiae light fuscous straw, tarsi dark brown, almost black.

Bred July 25, 1907, from badly rolled young ash leaflets taken at Newfoundland, N. J.

Type C. a1572a, N. Y. State Museum.

Arnoldia hispida n. sp.

Male. Length 1 mm. Antennae longer than the body, thickly haired, dark brown, fuscous basally, 12 segments. Mesonotum dark brown, the submedian lines yellowish. Scutellum yellowish orange, postscutellum pale yellowish. Abdomen pale brown, rather thickly clothed with fine setae. Halteres yellowish basally, whitish apically, coxae, femora and tibiae mostly pale yellowish, tarsi light brown.

Taken on Cornus at Albany, N. Y. July 6, 1906.

Type C. 519, N. Y. State Museum.

Arnoldia minor n. sp.

Male. Length .75 mm. Antennae extending almost to the tip of the abdomen, rather thickly haired, dark brown, fuscous basally, 12 segments; face fuscous. Mesonotum dark brown, the submedian lines indistinct. Scutellum dark brown, yellowish orange basally, postscutellum dark brown. Abdomen uniform dark brown. Halteres yellowish transparent, coxae pale orange, femora and tibiae pale yellowish, distally with narrow reddish or brownish bands, tarsi dark brown.

Taken on a window at Nassau, N. Y. July 1, 1906.

Type C. 431, N. Y. State Museum.

Arnoldia ungulata n. sp.

Male. Length 1 mm. Antennae a little longer than the body, rather thickly haired, light brown, the basal segments yellowish, 12 segments; face pale yellowish. Mesonotum dark brown, the orange submedian lines sparsely haired. Scutellum pale reddish, postscutellum pale orange. Abdomen sparsely haired, a pale orange, genitalia slightly fuscous. Halteres yellowish basally, fuscous apically. Legs a variable fuscous straw, the tarsi slightly darker.

Taken at Albany, N. Y. July 6, 1907.

Type C. 1221, N. Y. State Museum.

Arnoldia vitis n. sp.

Male. Length 1 mm. Antennae nearly as long as the body, thickly haired, fuscous yellowish, 12 segments, the basal ones yellowish. Mesonotum and dorsum of abdomen yellowish brown. Scutellum, postscutellum, parietes and incisures pale yellowish. Halteres yellowish basally, fuscous apically. Legs yellowish basally, dark brown distally.

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, rather thickly haired, dark brown, 12 segments, the basal segments and face yellowish. Mesonotum dark brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen a light fuscous yellowish, the incisures, pleurae and venter pale orange. Halteres yellowish basally, fuscous apically. Coxae and base of femora yellowish, tibiae and tarsi mostly dark brown.

Bred July 15, 1907, in association with Lasioptera vitis O. S. from the typical galls of this latter species. It would appear from the numbers reared that either species could produce this gall.

Type C. a1165a, N. Y. State Museum.

Dasyneura adhesa n. sp.

Male. Length .75 mm. Antennae nearly as long as the body, rather thickly haired, dark brown, 21 segments; face fuscous yellowish. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum dark brown. Abdomen dark brown, the segments rather sparsely margined posteriorly with yellowish hairs. Genitalia fuscous, pleurae and venter fuscous yellowish. Halteres whitish transparent. Coxae fuscous yellowish, femora and tibiae pale yellowish, narrowly annulate distally with dark brown or reddish brown. Tarsi brown, the distal segments darker.

Female. Length .75 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown, the basal segments yellowish, 22 segments. Mesonotum dark brown, the submedian lines rather thickly haired. Scutellum and postscutellum light fuscous yellowish. Abdomen a nearly uniform dark brown, the basal segments yellowish, the others narrowly margined posteriorly with yellowish, pleurae and venter yellowish. In some specimens the venter is thickly clothed with silvery hairs. Halteres yellowish transparent. Coxae, femora and tibiae mostly pale yellowish, the femora narrowly and variably annulate distally with fuscous, tarsi dark brown.

Bred July 16, 1907, from oval cells, between the adherent leaves of Solidago canadensis, identical with those made by Asphondylia monacha O. S. under similar conditions.

Type C. a1568, N. Y. State Museum.

Dasyneura anemone n. sp.

Male. Length 1.25 mm. Antennae about as long as the body, sparsely haired, reddish brown, 15 segments. Head reddish yellow. Mesonotum dark brown, the narrow submedian lines yellowish. Abdomen dark brown, the incisures and pleurae yellowish, the venter reddish orange. Halteres pale yellowish, femora pale yellowish basally, darker apically, the tibiae and tarsi dark brown, the latter almost black in some specimens.

Female. Length 1.25 mm. Antennae extending to the second abdominal segment, sparsely haired, reddish brown, 14 segments. Color characters about as in the male, except that the mesonotum is not so dark and the dorsal surface of the abdomen is more heavily clothed with fuscous hairs.

Bred July 12, 1907, from a loose bud gall on Anemone canadense taken at Kinderhook and Nassau, N. Y.

Type C. a1522, N. Y. State Museum.

Dasyneura coryli n. sp.

Male. Length 1 mm. Antennae longer than the body, sparsely haired, dark brown or black, basal segments pale yellowish, 14 segments. Mesonotum dark brown, the narrow submedian lines yellowish, sparsely haired. Scutellum and postscutellum pale yellowish. Abdomen dark orange, very sparsely clothed with fuscous hairs. Genitalia pale yellowish. Halteres large, yellowish basally, fuscous subapically. Legs with the coxae and base of femora pale yellowish, gradually becoming darker toward the tip, the distal portion of femora and tibiae light fuscous, tarsi dark brown.

Female. Length about 1 mm. Antennae not quite as long as the body, sparsely haired, pale yellowish, 13 segments. The entire body a pale lemon-yellow though the vestiture of the abdomen is abundant enough to give some indication of banding. Halteres dark brown. Legs pale yellowish.

Bred July 11, 1907, from a fuzzy wrinkled fold gall at the base of hazel leaves taken at West Nyack, N. Y.

Type C. a1543, N. Y. State Museum.

Dasyneura cyanococci n. sp.

Female. Length 1.25 mm. Antennae one half the length of the body, sparsely haired, dark brown, the basal segment and face yellowish, 15 segments. Mesonotum dark brown, the sub-

median lines thickly haired. Scutellum brownish red, postscutellum yellowish red. Abdomen dark brown, the incisures dark reddish, the venter pale yellowish. Genitalia fuscous. Halteres pale yellowish, slightly fuscous apically. Coxae and base of femora pale yellowish, the latter slightly fuscous distally, tibiae and tarsi dark brown.

Bred September 9, 1907, from a loose apical bud gall on blueberry taken at Stowe, Mass.

Type C. a1700, N. Y. State Museum.

Dasyneura fraxinifolia n. sp.

Male. Length .75 mm. Antennae nearly as long as the body, thickly haired, brown, the basal segments yellowish, 14 segments; face yellowish. Mesonotum reddish brown, the submedian lines pale yellowish. Scutellum light reddish brown, postscutellum a little lighter. Abdomen fuscous yellowish, the second to seventh segments shaded with light brown. Genitalia fuscous, venter light yellowish. Halteres yellowish basally, light brown apically. Legs a light straw, the distal tarsal segments darker.

Bred August 1, 1907, from tightly rolled ash leaves taken at Bath, N. Y.

Type C. a1648a, N. Y. State Museum.

Dasyneura salicifolia n. sp.

Male. Length 1.5 mm. Antennae nearly as long as the body, thickly haired, fuscous yellowish, 16 segments, the basal segment ventrally and face with patches of short, silvery hairs. Mesonotum dark brown, the lateral and submedian lines distinct and rather thickly clothed with long pale brown hairs. Abdomen dark brown dorsally, silvery laterally, pleura with patches of silvery hairs interrupted beneath. Halteres pale yellowish. Coxae pale yellowish with silvery hairs, femora pale silvery at base, fuscous apically, tibiae and tarsi darker.

Bred August 14, 1907, from young terminal adherent willow leaves.

Type C. a1675, N. Y. State Museum.

Rhabdophaga salicifolia n. sp.

Male. Length 1.5 mm. Antennae probably a little longer than the body, sparsely haired, dark brown, probably 20 seg-

ments; face fuscous. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum deep reddish brown, postscutellum dark fuscous. Abdomen dark brown, sparsely clothed with fine hairs. Halteres fuscous basally, fuscous yellowish apically. Legs a somewhat variable fuscous yellowish, femora basally light yellowish.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, fuscous yellowish, 20 segments; face fuscous with a patch of white scales just below the eyes. Mesonotum dark brown, the submedian lines rather thickly clothed with fine hairs. Scutellum reddish brown with numerous setae apically, postscutellum dark brown. Abdomen very sparsely clothed with fine hairs, brown, the incisures and pleurae deep orange; ovipositor pale yellowish. Halteres pale yellowish basally, fuscous apically. Legs fuscous yellowish.

Bred in July 1907, from a pouch gall on Spiraea salicifolia taken at Albany, N. Y.

Type C. a1505, N. Y. State Museum.

Asphondylia arizonensis n. sp.

Male. Length 4.5 mm. Antennae a little longer than the body, sparsely clothed with fine hairs, light brown, 14 segments. Mesonotum dark brown, nearly naked. Scutellum pale yellowish, postscutellum reddish brown. Abdomen light brown, rather thickly clothed with yellowish hairs, the eighth segment pale yellowish, genitalia fuscous. Halteres pale yellowish. Legs mostly a light yellowish brown, the distal tarsal segments reddish brown.

Female. Length 5 mm. Antennae nearly as long as the body, rather thickly clothed with fine hairs, light yellowish brown, 14 segments. Mesonotum grayish brown, the submedian lines rather thickly clothed with fine hairs. Scutellum light fuscous yellowish, postscutellum a little lighter. Abdomen light yellowish brown, thickly clothed with fine, grayish hairs, the eighth segment yellowish.

Bred May 18, 1882, from large galls resembling the fruit of the prickly pear occurring on Cactus at Fort Grant, Ariz.

Type C. 857, N. Y. State Museum, ⅹ 2676 U. S. Department of Agriculture.

Asphondylia auripila n. sp.

Male. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely clothed with short, yellowish hairs,

dark brown, 14 segments; face fuscous brown. Mesonotum brownish black, the submedian lines distinct, rather thickly clothed with yellowish hairs. Scutellum reddish brown with a few apical setae, postscutellum slightly darker. Abdomen reddish brown, the second and following segments very thickly clothed with long, golden yellow hairs. Halteres reddish brown, pale yellowish distally. Pleurae and coxae reddish brown, the femora, tibiae and tarsi a variable reddish brown.

Bred February 6, 1897, from galls on *Larrea tridentata* taken at Tucson, Ariz.

Type C. 851, N. Y. State Museum, # 7320 U. S. Department of Agriculture.

Asphondylia azaleae n. sp.

Male. Length 4 mm. Antennae nearly as as long as the body, thickly clothed with fine hairs, light brown, 14 segments; face fuscous yellowish. Mesonotum dark brown, the submedian lines thickly clothed with grayish hairs. Scutellum reddish brown, thickly clothed apically with long setae, postscutellum dark salmon. Abdomen dark brown, sparsely clothed with fine hairs, the segments rather thickly margined posteriorly with long setae, the eighth segment mostly pale orange, genitalia fuscous; pleurae rather thickly clothed with silvery white scales, the venter slightly lighter than the dorsum. Halteres yellowish white basally and apically, brown subapically. Coxae and femora fuscous yellowish, tibiae and tarsi mostly dark brown.

The female resembles the male closely in general appearance.

Bred June 15, 1907, from enlarged azalea buds taken at Albany, N. Y.

Type C. a1481, N. Y. State Museum.

Asphondylia brevicauda n. sp.

Female. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, reddish brown, 14 segments. Mesonotum dark brown. Scutellum yellowish red, postscutellum a little darker. Abdomen dark reddish brown, rather thickly haired. Halteres pale yellowish. Legs mostly yellowish brown, the tarsal segments darker.

Taken at Fort Yuma, Ariz. by H. G. Hubbard.

Type C. 1040, N. Y. State Museum.

Asphondylia bumeliae n. sp.

Male. Length 2 mm. Antennae a little shorter than the body, sparsely clothed with short hairs, light brown, 14 segments; face yellowish brown. Mesonotum light brown, indistinctly margined laterally and anteriorly with light yellowish, the submedian lines pale yellowish, sparsely clothed with fine hairs. Scutellum light yellow, postscutellum light brown. Abdomen light brown, rather thickly clothed with fine, yellowish hairs. Halteres yellowish basally, fuscous apically. Legs a variable brown, the extremities of tibiae and tarsi slightly darker.

Female. Length 2.5 mm. Color characters about as in the opposite sex.

Bred June 6, 1896, from galls on Bumelia lanuginosa taken at Nuecestown, Tex.

Type C. 849, N. Y. State Museum, ⚹ 745 U. S. Department of Agriculture.

Asphondylia hydrangeae n. sp.

Male. Length 4 mm. Antennae extending about to the fifth abdominal segment, thickly clothed with short, yellowish hairs, reddish brown, 14 segments; face and mouth parts yellowish brown. Mesonotum olive-brown, the anterior lateral angles yellowish, the submedian lines rather distinct and rather thickly clothed with yellowish hairs. Scutellum yellowish brown with numerous long, yellowish apical setae, postscutellum yellowish brown. Abdomen dark brown, thickly and rather uniformly clothed with rather short, yellowish or brown setae, the latter color more apparent along the median line, the hairs on the sides and venter yellowish or silvery white. Halteres yellowish basally, reddish brown apically; pleurae reddish brown, coxae and the femora basally yellowish brown, the distal portions of the femora, tibiae and tarsi a nearly uniform dark brown.

Bred May 6, 1884, from gall on Hydrangea arborescens taken in Virginia.

Type C. 852, N. Y. State Museum, ⚹ 3353 U. S. Department of Agriculture.

Asphondylia ilicoides n. sp.

Male. Length 3 mm. Antennae nearly as long as the body, sparsely clothed with short hairs, dark brown, basal segment pale at the base, 14 segments. Mesonotum brown, dusted with

pruinose, the submedian lines sparsely clothed with gray setae and with a lateral row of setae in front of the wing insertion. Pleura and scutellum concolorous with the mesonotum, the latter thickly clothed with long, grayish setae. Abdomen dark brown dorsally, sparsely clothed with gray setae, which are apparently longer posteriorly; ventrally the abdomen is yellowish red, rather thickly clothed with short, shining gray hairs. Halteres pale basally, fuscous subapically, slightly so apically. Coxae and the basal two thirds of the posterior femora luteous, the latter shading to a very dark brown apically. Tibiae and tarsi black, the anterior legs similarly colored; the mid legs have the femora quite a little darker at the base.

Female. Length a little less than 3 mm. Antennal and color characters about as in the opposite sex. Ovipositor when extended nearly as long as the body.

Bred June 20, 1907, from a small, oval, green bud gall on Ilicoides mucronata taken at Old Forge, N. Y.

Type C. a1548, N. Y. State Museum.

Asphondylia macrofila n. sp.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely clothed with short hairs, light brown, 14 segments; face reddish yellow. Mesonotum dark brown, the submedian lines sparsely clothed with yellowish hairs. Scutellum pale yellowish with a few fuscous apical setae, postscutellum dark brown. Abdomen reddish brown, rather thickly clothed with fine hairs, genitalia fuscous yellowish. Halteres yellowish, reddish brown subapically. Legs reddish brown, the tarsi slightly darker.

Female. Length 2 mm. Antennae a little shorter than the body, sparsely clothed with rather coarse hairs, dark brown, 14 segments. Color characters about as in the opposite sex.

Bred May 4, 1887, from galls on Amsinckia lycopsoides taken at Los Angeles and Alameda, Cal.

Type C. 855, N. Y. State Museum, ⁂ 175 in red ink, U. S. Department of Agriculture.

Asphondylia salictaria n. sp.

Female. Length 3.5 mm. Antennae about as long as the body, rather thickly clothed with fine hairs, yellowish brown, 14 segments. Mesonotum dark brown, the submedian lines fuscous yellowish, thickly clothed with long setae. Scutellum yellowish

brown with numerous coarse setae apically, postscutellum dull yellowish white. Abdomen brown, rather thickly clothed with fine setae, the segments variably margined posteriorly with whitish setae, the basal segment margined anteriorly and posteriorly with silvery white, venter thickly clothed with silvery hairs. Halteres yellowish basally, fuscous apically. Coxae and base of femora fuscous yellowish, distal portion of femora, tibiae and tarsi dark brown.

Bred May 15, 1899, from willow twigs taken at Pleasantville, Ind.

Type C. 859, N. Y. State Museum, ✕ 4423 U. S. Department of Agriculture.

Asphondylia smilacinae n. sp.

Male. Length 3 mm. Antennae as long as the body, rather thickly clothed with fine hairs, light brown, 14 segments. Mesonotum reddish brown, the sublateral areas darker with a distinct irregular fuscous area at the anterior and posterior lateral angles, the submedian lines indistinct, dull orange, sparsely clothed with short setae. Scutellum pale yellowish, thickly clothed with short setae, postscutellum orange yellowish. Abdomen a dull yellowish brown, the basal segment sparsely clothed with long, yellowish setae. Halteres fuscous yellowish. Coxae and base of femora yellowish brown, the distal portion of femora, tibiae and tarsi a variable dark yellowish brown.

Bred from September 26 to October 2, 1888, from deformed berries of Vagnera racemosa taken presumably at Washington, D. C.

Type C. 860, N. Y. State Museum, ✕ 4343 U. S. Department of Agriculture.

Rhopalomyia asteriflorae n. sp.

Female. Length 2.5 mm. Antennae extending to the third abdominal segment, sparsely haired, pale fuscous yellowish, 19 segments. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum dark brown with numerous coarse setae apically, postscutellum fuscous orange. Abdomen reddish brown, the incisures and pleurae dark orange, ventral sclerites dark brown, ovipositor fuscous yellowish. Halteres pale yellowish basally, fuscous apically. Coxae and base of femora fuscous yellowish, the distal portion of femora, tibiae and tarsi fuscous.

Bred September 25, 1907, from the somewhat dwarfed heads of Aster paniculata taken at Albany, N. Y.

Type C. a1757, N. Y. State Museum.

Rhopalomyia audibertiae n. sp.

Male. Length 1.5 mm. Antennae probably nearly as long as the body, sparsely haired, light brown, 14 segments. Mesonotum dark reddish brown. Scutellum reddish brown. Abdomen dark brown. Halteres yellowish transparent. Legs nearly uniform light straw.

Bred in April, from gall on Audibertia stachyoides.

Type C. 1029, N. Y. State Museum.

Rhopalomyia clarkei n. sp.

Female. Length 2 mm. Antennae about two thirds the length of the body, sparsely haired, fuscous yellowish, the basal segment and face fuscous; 17 segments. Mesonotum shining dark brown, the submedian lines sparsely haired. Scutellum dark red, postscutellum fuscous. Abdomen dull red, the small dorsal sclerites somewhat fuscous, membrane and pleurae deep reddish orange, ovipositor fuscous yellowish. Halteres yellowish basally, fuscous subapically, dull orange apically. Legs a variable fuscous yellowish.

Bred October 8, 1907, from a very small, fusiform, pale green gall occurring mostly on the underside of the terminal leaves of Solidago rugosa and taken by Miss Cora H. Clarke at Tamworth, N. H.

Type C. a1634, N. Y. State Museum.

Hormomyia consobrina n. sp.

Male. Length 5.5 mm. Antennae extending to the fifth abdominal segment, rather sparsely clothed with fine hairs, dark brown, 15 segments; face dark brown and yellowish. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum pale orange yellow, postscutellum a little darker. Abdomen dark brown, the eighth segment mostly yellowish; genitalia fuscous, venter pale yellowish orange. Halteres pale yellowish. Legs light fuscous yellowish.

Taken May 25, 1907, on dormant azalea.

Type C. 1204, N. Y. State Museum.

Hormomyia johnsoni n. sp.

Male. Length 5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown, 14 segments;

face dark reddish brown. Mesonotum very dark brown, the submedian lines narrow, dark yellowish. Scutellum brown, reddish apically and laterally, postscutellum dark brown, reddish basally. Abdomen sparsely clothed with fine hairs, shining black. Halteres pale reddish, yellow basally, slightly fuscous apically. Legs a variable fuscous yellowish, distal tarsal segments darker.

Taken May 28, 1906, by Prof. C. W. Johnson at Auburndale, Mass.

Type C. 821, N. Y. State Museum.

Hormomyia palustris n. sp.

Male. Length 7 mm. Antennae nearly as long as the body, rather thickly clothed with fine hairs, pale yellowish, 25 to 27 segments; face fuscous. Mesonotum brown with the broad submedian lines and posterior median area yellowish. Scutellum pale yellowish, postscutellum yellowish, margined posteriorly with fuscous. Abdomen yellowish with the first four segments mostly pale yellowish transparent, the fifth, sixth and seventh segments dull orange, genitalia fuscous yellowish. Halteres pale yellowish white. Legs a nearly uniform pale yellowish.

Taken May 20, 1907, in considerable numbers on a lake marsh at Ithaca, N. Y. by Dr James G. Needham.

Type C. 1205, N. Y. State Museum.

Dichrodiplosis multifila n. sp.

Male. Length 1.5 mm. Antennae about as long as the body, thickly haired, fuscous brown, 14 segments. Mesonotum dark brown, the submedian lines indistinct. Scutellum dark reddish brown, postscutellum fuscous. Abdomen dark brown, the segments sparsely margined posteriorly with coarse setae. Halteres fuscous yellowish. Coxae and base of femora pale yellowish, distal portion of femora, tibiae and tarsi a variable brown.

Taken at Porto Rico by August Busck.

Type C. 1024, N. Y. State Museum, ✕ 339 U. S. Department of Agriculture.

Dichrodiplosis quercina n. sp.

Male. Length 1.5 mm. Antennae ¼ longer than the body, thickly haired, light brown, 14 segments. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum yellowish brown, postscutellum darker. Abdomen reddish brown,

genitalia lighter, the segments rather thickly margined posteriorly with brown setae. Halteres pale yellowish. Legs light straw.

Bred April 6, 1893, from leaves designated as English laurel, probably Quercus, taken at Augusta, Ga.

Type C. 1006, N. Y. State Museum, ☓ 5493 U. S. Department of Agriculture.

Arthrocnodax apiphila n. sp.

Male. Length 1 mm. Antennae ¼ longer than the body, thickly haired, fuscous straw, basal segment and face yellowish, 14 segments. Mesonotum yellowish or reddish brown, the submedian lines indistinct. Scutellum yellowish or orange yellow, postscutellum yellow or orange yellowish. Abdomen yellowish or deep carmine. Genitalia fuscous yellowish. Halteres pale orange. Coxae and femora basally pale yellowish, the femora distally and tibiae light straw, tarsi light brown, the distal segments darker.

Bred October 8, 1907, by Burton N. Gates, expert in apiculture, Washington, D. C., from small larvae which appeared to be feeding in mite infested material and excrement of old bee combs received from California.

Type C. a1775, N. Y. State Museum.

Mycodiplosis corylifolia n. sp.

Male. Length 1 mm. Antennae about as long as the body, rather thickly haired, light brown, the basal segments yellowish, 14 segments. Thorax and abdomen a nearly uniform pale yellowish, the scutellum and base of the abdomen a little darker; genitalia whitish transparent. Coxae and base of femora mostly yellowish transparent, the distal portion of femora and tibiae pale yellowish, the tarsi fuscous straw, the distal segments darker.

Female. Length 1.75 mm. Antennae as long as the body, sparsely haired, pale straw, 14 segments. Thorax and abdomen a very pale lemon-yellow. Halteres yellowish transparent. Legs yellowish transparent basally, the tarsi a very pale yellowish straw.

Bred July 23, 1907, from a fuzzy wrinkled fold gall at the base of hazel leaves taken at West Nyack, N. Y.

Type C. a1543b, N. Y. State Museum.

Contarinia agrimoniae n. sp.

Male. Length 1 mm. Antennae a little longer than the body, sparsely haired, pale straw, 14 segments; face pale yellowish. Mesonotum fuscous, the submedian lines indistinct. Scutellum and postscutellum fuscous. Abdomen a fuscous greenish white or yellowish. Halteres yellowish. Coxae pale yellowish, femora, tibiae and tarsi mostly brown.

Female. Length 1.25 mm. Antennae as long as the body. Color characters about as in the opposite sex.

Bred September 3, 1907, from flowers of Agrimonia eupatoria taken at Bath, N. Y., August 16, 1907.

Type C. a1696, N. Y. State Museum.

Cecidomyia cerasifolia n. sp.

Male. Length .75 mm. Antennae twice the length of the body, thickly haired, yellowish brown, 14 segments, the basal segment and face yellowish. Mesonotum dark brown, the submedian lines indistinct. Scutellum bright red, the postscutellum a little darker. Abdomen yellowish brown or reddish, membrane and pleurae brown on the basal segments, genitalia yellowish. Halteres yellowish orange, fuscous subapically. Coxae yellowish, femora, tibiae and tarsi a light straw.

Bred September 4, 1907, from irregularly thickened folded chokecherry leaves taken at Newfoundland, N. J.

Type C. a1571, N. Y. State Museum.

Cecidomyia floricola n. sp.

Male. Length 1 mm. Antennae ¼ longer than the body, sparsely haired, pale straw, 14 segments; face pale yellowish. Mesonotum brown, the submedian lines indistinct. Scutellum yellowish with a few long setae, postscutellum yellowish. Abdomen pale yellowish, the segments margined posteriorly with long hairs. Halteres pale yellowish. Coxae, femora and tibiae pale yellowish, tarsi brownish gray, the segments paler basally.

Bred August 15, 1907, from somewhat enlarged reddened flowers of Spiraea salicifolia taken at Albany, N. Y.

Type C. a1681, N. Y. State Museum.

Cecidomyia macrofila n. sp.

Male. Length 1 mm. Antennae a little longer than the body, thickly haired, light brown, 14 segments. Mesonotum reddish

brown. Scutellum light reddish yellow, postscutellum darker. Abdomen reddish brown. Halteres yellowish transparent. Coxae, femora and tibiae pale yellowish, tarsi reddish brown.

Bred August 6, 1902, from fungus taken at Las Vegas, N. M.

Type C. 1023, N. Y. State Museum.

Cecidomyia piperitae n. sp.

Female. Length 1.25 mm. Antennae as long as the body, sparsely haired, brown; 14 segments, basal segments and face yellowish. Mesonotum a shaded orange-red, the submedian lines indistinct. Scutellum reddish basally, light fuscous apically, postscutellum deep orange. Abdomen pale orange. Halteres pale yellowish, slightly fuscous subapically. Legs a light yellowish orange, the anterior variably tinged with carmine.

Bred September 4, 1907, from peppermint, Mentha piperita taken at Nassau, N. Y.

Type C. a1663c, N. Y. State Museum.

Cecidomyia scrophulariae n. sp.

Male. Length 1.5 mm. Antennae ¼ longer than the body, thickly haired, light brown, basal segments yellowish, 14 segments. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum yellowish brown, postscutellum fuscous. Abdomen pale yellowish carmine, the basal segments apparently with a variable fuscous spot. Genitalia fuscous yellowish. Halteres yellowish transparent. Legs a variable fuscous straw, the tarsi nearly black.

Bred August 8, 1907, from distorted flower buds of Scrophularia marylandica taken at West Nyack, N. Y.

Type C. a1569, N. Y. State Museum.

Cecidomyia setariae n. sp.

Male. Length 1.5 mm. Antennae longer than the body, thickly haired, light brown, basal segments pale yellowish, the face light reddish, 14 segments. Mesonotum reddish, darker laterally, submedian lines indistinct. Scutellum darker than the mesonotum, postscutellum reddish. Abdomen reddish yellow, sparsely clothed with long hairs, membrane and pleurae reddish yellow. Halteres pale reddish or yellowish, coxae pale yellowish, anterior and mid femora and tibiae gray, the posterior femora and tibiae yellowish, the anterior and mid tarsi brownish, the posterior tarsi with the two basal segments yellowish, the others brown.

Bred August 25, 1907, from seeds of the common foxtail grass taken at Albany, N. Y.

Type C. a1721, N. Y. State Museum.

Cecidomyia spiraeaflorae n. sp.

Male. Length 1.5 mm. Antennae ½ longer than the body, rather thickly haired, pale straw, 14 segments; face pale fuscous. Mesonotum brown, the submedian lines whitish. Scutellum yellowish. Abdomen a greenish bronze, the first segment yellowish. Halteres pale fuscous yellowish. Coxae pale yellowish, femora yellowish at the base, fuscous apically, tibiae and tarsi also fuscous.

Bred August 24, 1907, from slightly enlarged reddened flowers of Spiraea salicifolia taken at Albany, N. Y.

Type C. a1681b, N. Y. State Museum.

Bryocrypta pectinata n. sp.

Male. Length 1.75 mm. Antennae about ¼ longer than the body, sparsely haired, pale yellowish, 16 segments; face yellowish. Mesonotum a light fuscous yellowish. Scutellum, postscutellum and abdomen a pale yellowish. Halteres yellowish transparent. Legs a nearly uniform yellowish straw.

Bred August 9, 1907, from a jar containing several basswood leaves, each with irregular subglobular swellings along the mid vein. This species may be an inquiline or it may have lived on the decaying leaf tissues.

Type C. a1599, N. Y. State Museum.

Winnertzia pinicorticis n. sp.

Male. Length 1 mm. Antennae as long as the body, rather thickly haired, fuscous yellowish, 14 segments. Mesonotum dark brown, sparingly clothed with yellowish setae, the submedian lines indistinct. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown. Halteres pale yellowish. Legs a nearly uniform fuscous yellowish.

Bred February 16, 1892, from bark of Pinus inops taken at Strom, Va.

Type C. 1047, N. Y. State Museum, ✕ 5217 U. S. Department of Agriculture.

CIRCUMFILI OF THE CECIDOMYIIDAE[1]

These peculiar antennal structures are what have been more generally known as arched filaments. They were first discovered by Targioni-Tozetti in 1888 and independently observed by Kieffer in 1895. They are most highly developed in the male Diplosids [fig. 43], consisting in these forms of nearly homogeneous whorls of long, looped filaments extending around the enlargements of the segments. Each loop is closely fused to the base of its fellow, and the entire whorl presents every appearance of being one structure. This peculiar development also occurs in female Diplosids, being represented in this sex by slightly elevated, nearly colorless threads supported by minute stalks. There is usually, in this sex, a circumfilum near the base and one near the apex of the enlargement of each segment, the two being connected by one or more longitudinal fili. There is very rarely a connection between the two or three circumfili on a segment in the male Diplosid; though an evidently abnormal connection of this character has been observed in the case of the male Hormomyia americana Felt [fig. 42]. The homologous character of these apparently different structures in the two sexes is confirmed by the fact that in the male Bremia [fig. 44] the basal circumfilum of the distal enlargement is low and exactly like that of the female. These structures occur not only in the Diplosids but also in practically all other Cecidomyiinae, not being present, so far as known to us, in the Lestreminae. The genus Lasioptera has these structures in a very simple form, they being in both sexes merely slightly elevated threads supported by slender stalks and joined on at least one face of the segment. Rhabdophaga and its allies have a similar arrangement, except that in the male there is a slight indication of greater specialization, and the same is practically true of Rhopalomyia. The most striking variations on some accounts are those found in the Asphondyliariae. The circumfili in the male Asphondylia [fig. 38] consists of a more or less variable series of extremely tortuous, slightly elevated threads

[1] Read at the third meeting of the Entomological Society of America held at Chicago, Ill., December 30, 31, 1907.

reaching from the apex of the segment to its base, usually in the form of two more or less well defined loops. In the female, the circumfili girdle the segment near its basal fourth and apically and are united on one face by a longitudinal filum. The genus Schizomyia [fig. 39] in the Asphondyliariae is notable because of its thicker, more elevated and more strongly convolute circumfili, though the general plan is similar to what obtains in Asphondylia. The genus Cincticornia [fig. 41], on the contrary, presents remarkable modifications, in that the male antennal segment may be girdled by 10 or more low anastomosing circumfili, while the antennal segment of the female is literally inclosed in a coarse reticulation of these peculiar structures. Furthermore, it should be added that these strikingly modified circumfili are accompanied by marked and relatively constant variations in other organs. The male Diplosids, as noted above, present the maximum development in these structures. The genus Contarinia [fig. 43], for example, is more easily separated from other genera by the occurrence of but two even circumfili in the male, than by the apparent uniformity of the enlargements of the antennal segments. The genera Bremia and Aphidoletes [fig. 44, 45] are remarkable in that the slender circumfili are greatly produced on one side, even to a length equal twice that of the entire segment. The Epidosariae show considerable variation in these structures, there being a marked tendency toward the production of long, slender tips at the apex of the segment. The most unique type is found in the genus Winnertzia [fig. 48], in which the circumfili appear to be modified to form horseshoelike appendages, one on each face of the segment, the produced free ends extending beyond the apex of the enlarged portion of the segment.

These structures appear to have no homologies in related groups, unless they are analogous to the peculiar, apparently fleshy hypodermal structures protruding from relatively large, symmetrically placed orifices on the antennal segments of the Campylomyzariae [fig. 31] and of certain Chironomidae.

The origin of these peculiar structures is not easy to determine. Kieffer, several years ago, suggested that they might be remnants of hypodermal lamellae, the margins of which had become thickened and chitinized, while the membranous portion disappeared. At that time we accepted his theory tentatively, as we had nothing better to offer. It is now extremely difficult

to hold this as an adequate explanation of the origin of these structures, when one considers the very tortuous courses taken by these fili in the male Asphondylia for example, or the bizarre form presented in Winnertzia. Furthermore, if these structures were originally the thickened margins of lamellae, we would expect traces of a membrane in some of the lower forms such, for example, as the females of Dasyneura, Rhabdophaga and Lasioptera. There appears to be no trace of any such remnant, and we are therefore led to believe that these organs may be hypodermal structures which, through a process of development, have migrated from the interior of the antennal segment, becoming external, and thus greatly increased their value as auditory organs. An alternative explanation is that the circumfili are simply specially modified setae which have become, in some unknown manner, most intimately connected one with the other.

STUDIES IN CECIDOMYIIDAE II

The following matter relating to the Cecidomyiidae represents only a small portion of our work upon this group. It is published as a preliminary contribution to the classification of our American forms. The tables for the separation of the major groups, genera and species have been sorely needed in the past, and will undoubtedly have a most important influence on all subsequent work in this extremely interesting and very important group.

PRELIMINARY KEYS FOR THE RECOGNITION OF CERTAIN CECIDOMYIIDAE

The following diagnoses and keys should prove of considerable service in identifying many of the American species belonging to this exceedingly interesting group. They are to be regarded as tentative, since it has been impossible for us to go over the entire material in a thorough manner, and further study may lead to considerable modification in our views.

Keys to subfamilies and tribes

a Metatarsus longer than the following segment; five tarsal segments and at least four long veins
- *b* Fourth long vein present.................Subfamily *LESTREMIINAE*
  - *c* Fourth vein forked.....................Tribe *LESTREMIINARIAE*
  - *cc* Fourth vein simple..................Tribe *CAMPYLOMYZARIAE*

aa Metatarsus usually longer than the following segment; at least three long veins............................Subfamily *HETEROPEZINAE*

aaa Metatarsus always shorter than the following segment; wings with three or four long veins.......................Subfamily *CECIDOMYIINAE*

b Third vein simple at base, not forked

c Costa thickly scaled, third vein close to the anterior margin of the wing....................................Tribe *LASIOPTERARIAE*

cc Costa rare thickly clothed with scales, the third vein well separated therefrom

d Antennae cyclindric, never binodose in the male

e Claws toothed......................Tribe *DASYNEURIARIAE*

ee Claws simple

f Antennal segments cylindric or subcylindric, not elongated, usually stalked in the male.. Tribe *OLIGOTROPHIARIAE*

ff Antennal segments cylindric, elongated sessile................ Tribe *ASPHONDYLIARIAE*

dd Antennae binodose in the male............ Tribe *DIPLOSARIAE*

bb Third vein forked at the base, apparently arising in most species directly from subcosta.........................Tribe *EPIDOSARIAE*

LESTREMIINAE

The Lestremiinae are easily recognized by the metatarsus being distinctly longer than the following segments, and by the presence of five tarsal segments and at least four long veins.

LESTREMIINARIAE

This tribe is easily distinguished from the following by the distinctly forked fourth vein [pl. 33, fig. 1–3].

Key to genera

a Costa continuous and extending beyond the apex of the wing............ Catocha Hal.

aa Costa not attaining the apex of the wing, practically disappearing at its union with the 3d vein

b Antennae greatly reduced; 8 to 9 segments in the male, the 2d greatly enlarged; in the female 10 short segments, the 2d somewhat enlarged Microcerata n. g.
(Type Micromyia corni Felt, C. 459)

bb Antennae not greatly reduced; male with 16, female with 11 antennal segments...Lestremia Macq.

CATOCHA

Members of this genus are easily recognized by the costa being continuous and extending beyond the apex of the wing, where it is joined by the third vein; the fourth vein is forked, the cell usually being distinctly shorter than in Lestremia. The antennae differ greatly from those of Lestremia, being in the male of C. americana [fig. 29] distinctly binodose, while in the case of C. slossonae the basal enlargement is distinctly prolonged and

provided with several whorls of setae. The genitalia are also of a different type.

Nothing is known concerning the life history of American forms. Kieffer states that the larvae of the European C. muscicola Kieff. occur on mosses. It is probable that these forms are sylvan as in the case of Lestremia and allied genera.

Key to species

a Length 4 mm; antennae binodose ....americana n. sp., C. 929
aa Length 1.5 mm; antennae not binodose.......slossonae n. sp., C. 931

Fig. 29 Catocha americana n. sp., 6th antennal segment of male, much enlarged. (Original)

MICROCERATA n. g.

This genus has been erected to include several forms remarkable because of the greatly reduced male antennae. These organs are composed of but 8 to 9 short segments, the second being greatly enlarged and in general appearance much resembling those of the Campylomyzine genus Micromyia. The genitalia also differ from those of Lestremia. The female, which we have provisionally associated with the above mentioned male, has very small antennae composed of 10 short joints, the second being somewhat enlarged.

The form described, M. perplexa, appears to be closely related to M. diervillae Felt, and it is possible that it is the female of this species.

Key to species

a Antennal segments 8
- *b* 4th palpal segment more than twice the length of the 3d; harpes broadly rounded apically ....johnsoni n. sp., C. 802
- *bb* 4th palpal segment nearly twice the length of the 3d; harpes subacute apically........ ....cockerelli n. sp., C. 932

aa Antennal segments 9
- *b* Subcosta uniting with the margin before the basal half; wings small, narrow ....(Micromyia) corni Felt, C. 459
- *bb* Subcosta uniting with the margin at the basal half; wings rather large, broad·.........(Micromyia) diervillae Felt, C. 490

aaa Antennal segments 10
- *b* Length 1.5 mm; body dark brown................perplexa n. sp.

LESTREMIA Macq.

This genus is easily recognized by the characteristic fork of the fourth vein, by costa not attaining the apex of the wing and by the antennae being well developed, those of the male having 16 and those of the female 11 segments. The segments of the female antennae are short, subcylindric or subconical and in some species at least, ornamented distally with thick rows of short, stout, chitinous, sensory processes. The male antennae are composed of 16 segments, which latter are provided with a distinct stem nearly as long or longer than the basal enlargement, which in turn is ornamented by one or more crenulate whorls from the base of which arise long, curved setae. The genitalia are very characteristic.

Nothing is known concerning the life history and habits of members of this genus, aside from the fact that they are most abundant in the vicinity of forests. Kieffer states that the European L. leucophaea Meig. occurs in decaying beech wood and it is very probable that our American forms breed largely in rotting ligneous tissues.

Key to species

a Antennal segments 11; females
- *b* Abdomen reddish brown
  - *c* Scutellum dark brown; basal segment of ovipositor with a length fully twice its width; terminal segment small, narrowly oval and distinctly shorter than the basal segment.......................
elongata n. sp., C. 933
  - *cc* Scutellum yellowish brown; basal segment of ovipositor broadly triangular, its length not more than ½ greater than its width; terminal segment nearly as long as the basal one, narrowly oval.....
barberi n. sp., C. 934

bb Abdomen fuscous yellowish
c Length 3 mm
d Terminal segment of ovipositor orbicular; claws minutely denticulate ....(Catocha) sylvestris Felt, a1642
cc Length 1.5 mm
d 4th palpal segment ¼ longer than the 3d; basal segment of the ovipositor ½ longer than broad (Catocha)............... sambuci Felt, C. 743
dd 4th palpal segment twice the length of the 3d; basal segment of ovipositor a little longer than broad.kansensis n. sp., C1261
aa 16 antennal segments; males
b Stems of antennal segments ⅔ or ¾ the length of the subcylindric basal enlargement
c Dorsal plate short, broad, triangularly emarginate, the four palp segments successively longer..................pini Felt, C. 562
cc Dorsal plate broad, tapering, roundly emarginate, the 3d and 4th palp segments not longer than the preceding (Campylomyza) acerifolia Felt, C. 71
bb Stems of antennal segments as long as the basal enlargement
c Basal clasp segment with a conspicuous setose basal lobe internally (Catocha) solidaginis Felt, C. 700, 633, 691
cc Basal clasp segment with no well developed basal lobe internally
d 4th palpal segment as long as the 3d
e Scutellum fuscous yellowish; dorsal plate not convolute, nearly truncate distally.......................setosa n. sp., Sc. 22
dd 4th palpal segment ½ longer than the 3d
e Abdomen dark brown; scutellum reddish brown; dorsal plate convolute, broadly rounded distally and margined posteriorly with moderate setae (Catocha)..spiraeina Felt, C. 274
ee Abdomen dark yellowish brown; scutellum yellowish brown; dorsal plate obliquely truncate distally and margined posteriorly with stout, divergent setae..franconiae n. sp., C. 930
bbb Antennal stem ¼ longer than the basal enlargement
c Abdomen dark reddish brown; scutellum yellowish brown; basal enlargement of antenna with two crenulate whorls and with a length about twice its diameter; terminal clasp segment bidentate apically..................................dyari n. sp., C. 935
cc Abdomen dark brown; scutellum dark reddish brown; basal enlargement of antenna with one crenulate whorl and with a length a little greater than its diameter; terminal clasp segment acute distally................................vernalis n. sp., C. 1260

CAMPYLOMYZARIAE

Members of this group are easily distinguished from the Lestremiinariae by the simple character of the fourth vein [pl. 33, fig. 4, 5, 7]. We recognize at present the two genera Joanissia and Campylomyza, though the latter comprises a number of divergent forms which should probably be referred to different genera.

Key to genera

a Antennal segments globose with a smooth stem distally and ornamented only with whorls of long hairs. The 3d vein is well separated from costa and unites with the margin at or beyond the apex............ Joanissia Kieff.

aa Antennae variable, frequently with crenulate whorls and subapically with variously formed chitinous structures; the 3d vein uniting with the margin before or near the apex...................Campylomyza Meig.

JOANISSIA Kieff.

This genus presents a very characteristic form and is easily separated from all other Cecidomyiids. The antennae in both sexes are composed of a number of segments, each consisting of a subglobu-

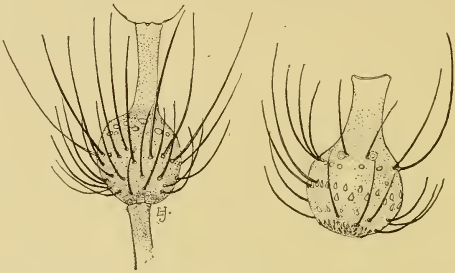

Fig. 30 Joanissia photophila Felt, 5th and 10th antennal segments of male, much enlarged. (Original)

lar basal enlargement ornamented only with irregular whorls of simple setae and a smooth, cylindric stem distally [fig. 30]. The male has 14 and the female 11 antennal segments. The palpi are tri or quadriarticulate. The venation of the wing is very characteristic, as the third vein is well separated from costa, runs nearly parallel thereto and unites with the margin at or well beyond the apex; the fourth vein is simple.

Nothing is known concerning the life history of our native forms, though Kieffer has recorded the rearing of several European species from decaying wood, from tufts of moss and also from a mold covering a fungus. It is very probable that our American forms live under similar conditions, particularly as they seem most abundant in the vicinity of forests or other conditions where decaying vegetable matter is present in some abundance.

Key to species

a 14 antennal segments, males
- *b* Legs thickly haired
  - *c* Postscutellum reddish brown................................. (Campylomyza) photophila Felt, C. 747, 748, 753, 472
  - *cc* Postscutellum fuscous yellowish....flavoscuta n. sp., C. 653
- *bb* Legs sparsely haired.. (Campylomyza) carolinae Felt, C. a1619

aa 11 antennal segments, females
- *b* Abdomen dark brown, unicolorous; palpi triarticulate.............. flavopedalis n. sp., C. 687
- *bb* Abdomen dark reddish brown, fuscous distally; palpi quadriarticulate...............(Campylomyza) carolinae Felt, a1619

CAMPYLOMYZA Meig.

We have deemed it advisable to include under this name, for the present at least, all those forms not referable to Joanissia Kieff.,

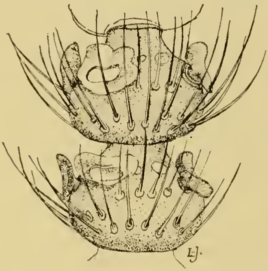

Fig. 31 Campylomyza lignivora Felt, 5th and 6th antennal segments of female, much enlarged. (Original)

despite the fact that the species can evidently be broken up into groups, some of which should be accorded generic value.

Key to species

a 11 antennal segments
- *b* Antennal segments with the stem ¼ longer than the basal enlargement...................................flavoscuta Felt, C. 117
- *bb* Antennal stem very short, the segments subsessile, females
  - *c* Subcosta uniting with the margin at the distal third
    - *d* Abdomen fuscous yellowish, unicolorous; antennal segments stout, short haired ....bryanti n. sp., C. 796
    - *dd* Abdomen fuscous yellowish, reddish basally; antennal segments rather slender, long haired......................... sylvestris Felt, C. a1620
    - *ddd* Abdomen reddish brown; antennal segments stout with subapical whorls of stout, chitinous spines..luna n. sp., C. 547

cc Subcosta uniting with the margin at the basal half
d Mesonotum dark brown; scutellum dark reddish brown.... brevicornis Felt, C. 725, 756, 882, 1229
ccc Subcosta uniting with the margin at the basal 3d; abdomen fuscous yellowish; antennal segments stout, with stemmed disks gilletti n. sp., C. 1239a
aa 12 antennal segments, females
b Scutellum pale reddish yellow; abdomen pale fuscous yellow; antennae with stemmed disks...........toxicodendri Felt, C. 122
bb Scutellum reddish brown; abdomen fuscous yellowish; antennal segments with curved, chitinous spines subapically.................. versicolor n. sp., C. 617
bbb Scutellum dark brown; abdomen dark fuscous yellowish; antennal segments with a subapical chitinous collar
c Chitinous collar on antennal segments apparently incised; 3d palpal segment narrowly oval, with a length about twice its diameter..... ....defectiva n. sp., C. 715
cc Chitinous collar on antennal segments heavy, not incised; 3d palpal segment slender
d Wings long, narrow; 4th palpal segment twice the length of the 3d, greatly dilated ....silvana n. sp., C. 883
dd Wings medium; 4th palpal segment with a length ½ greater than the 3d ....simulator n. sp., C. 885
bbbb Scutellum and abdomen dark brown; antennal segments with stout, chitinous spines subapically..........kasloensis n. sp., C. 881
aaa 13 antennal segments
b Antennal segments with a distinct stem and with crenulate chitinous whorls; male...............................vitinea Felt, C. 759
bb Antennal segments subsessile, with no distinct stem; crenulate whorls absent; females
c Antennal segments with a flaring chitinous collar subapically
d Wings long, slender
e 5th tarsal segment on posterior legs with a length fully 1½ to twice the diameter; terminal segment of ovipositor somewhat produced, broadly oval.............. tsugae Felt, C. 166
ee 5th tarsal segment on posterior legs with a length 2 to 2½ times the diameter; terminal segment of ovipositor suborbicular ....boulderi n. sp., C. 886
dd Wings broad; length 2.5 mm, abdomen dark reddish brown.. latipennis n. sp., C. a1457
cc Antennal segments without subapical chitinous collar; scutellum dark reddish brown ....longipennis n. sp., C. 733
aaaa 15 antennal segments; each with the stem ¼ longer than the basal enlargement; males
b Mesonotum black; abdomen dark brown.......carpini Felt, C. 107
aaaaa 16 antennal segments; each with the stem ⅓ the length of the subcylindric basal enlargement; males
c Mesonotum black; abdomen dark brown....................... lignivora Felt, C. a1614

aaaaaa 20 or more antennal segments; stemmed disks present; females
b 21 antennal segments; gland orifices on 7th abdominal segment trumpet-shaped..............................l i g n i v o r a Felt, C. a1614
bb 22 antennal segments; gland orifices on 7th abdominal segment subglobular ....a r t i c u l o s a n. sp., C. 884
aaaaaaa 14 antennal segments
b Antennal segments subsessile, stem only ¼ or ⅓ the length of the subcylindric basal enlargement
c Abdomen fuscous yellowish; mesonotum reddish brown; subcosta uniting with the margin near the middle................ p i n i c o r t i c i s n. sp., C. 799
cc Abdomen reddish or dark brown
d Subcosta uniting with the margin at the distal third........ g r a m i n e a Felt, C. 5
dd Subcosta uniting with the margin at the basal half
e Enlargement of the antennal segment with a length ½ greater than its diameter and bearing 6 whorls of short, stout, obtuse setae; palpi stout..h i r s u t a n. sp., C. 729
ee Enlargement of antennal segment with a length ¾ greater than its diameter and bearing 5 whorls of short, stout, obtuse setae; palpi slender..c u r r e i n. sp., C. 881a
ddd Subcosta uniting with the margin at the basal 3d
e Terminal clasp segment swollen at the distal 3d; abdomen dark brown or black....l e g u m i n i c o l a Felt, C. 121
bb Antennal segments with the stem about ½ the length of the subcylindric basal enlargement
c Abdomen dark brown....................p o p u l i Felt, C. 115
cc Abdomen yellowish
d Antennal segments asymmetrical, the middle claw denticulate...........................p r o d u c t a n. sp., C. 726
dd Antennal segments symmetrical...... p o m i f o l i a, a379
bbb Antennal segments with a smooth stem about ¾ the length of the subcylindric basal enlargement; males
c Terminal clasp segment short, stout, pulvilli present
d Terminal clasp segment greatly swollen near the middle, the 4th palpal segment slender, twice as long as the preceding p o m i f l o r a e Felt, C. 12
dd Terminal clasp segment short, greatly swollen near the distal 3d, the 4th palpal segment slender, twice as long as the preceding..................b a l s a m i c o l a Felt, C. 145
ddd Terminal clasp segment moderately swollen near the distal 3d, 4th palpal segment ½ longer than the 3d............. k a r n e r e n i s Felt, C. 29
dddd Terminal clasp segment moderately swollen near the middle, the 4th palpal segment about twice the length of the preceding
e Wings narrow................h e s p e r i a n. sp., C. 714
ee Wings broad............l a t i p e n n i s n. sp., C. a1457
cc Terminal clasp segment prolonged, swollen and broadly rounded distally and with a distinct stem basally; pulvilli present

d Basal enlargement of the antennal segments with a length about ½ greater than its diameter; the 4th palpal segment ½ longer than the 3d.........barlowi n. sp., C. 798

ccc Terminal clasp segment long, more or less flattened, not roundly swollen; pulvilli absent

d Basal enlargement of the antennal segment with a length fully twice its diameter; the 4th palpal segment twice the length of the 3d, the base of the terminal clasp segment not greatly flattened and dilated......cerasi Felt, C. 18

dd Basal enlargement of the antennal segment probably with a length not more than ½ greater than its diameter; the 4th palpal segment only ½ longer than the 3d; terminal clasp segment broad at base, strongly flattened................ gibbosa Felt, C. 162

bbb Antennal segments with a smooth stem fully ¼ longer than the basal enlargement; males

c Terminal clasp segment stout, elongate, ovoid; palpi quadriarticulate..............................modesta Felt, C. 147

cc Terminal clasp segment stout, produced, not dilated; palpi triarticulate..........................texana n. sp., C. 1258

ccc Terminal clasp segment much produced; palpi quadriarticulate...............................tuckeri n. sp., C. 1259

cccc Terminal clasp segment greatly dilated, subtriangular in outline................................dilatata Felt, C. 1109

HETEROPEZINAE

This subfamily comprises a few peculiar forms. The metatarsus is usually longer than the following segment and there are at most three long veins. The ocelli are wanting and the second tarsal segment is somewhat shorter than the first. The American representatives of this group may be separated by the following table.

Key to genera

a Wing; membrane finely haired, the long veins simple

b Tarsi quadriarticulate, the metatarsus longer than the second segment ....Miastor Mein.

bb Tarsi biarticulate, the metatarsus shorter than the second segment... Oligarces Mein.

aa Wing; membrane thickly scaled

b Three simple long veins, the tarsi 5 segmented....Brachyneura Rond.

Miastor Mein.

But one American representative of this genus, M. americana Felt, is known. This species was taken at Highland, N. Y., on either beech or chestnut leaves.

Oligarces Mein.

Only one American representative is known; namely, O. noveboracensis Felt. This species was taken in July and presumably bred from material brought into the office.

Brachyneura Rond.

This peculiar genus is easily separated from Lasioptera, which it closely resembles in a general way, by the densely scaled fuscous wings [pl. 33, fig. 6].

Two American species of Brachyneura have been reared. One, B. eupatorii, was bred presumably from an oval swelling on Eupatorium perfoliatum. The other species, B. vitis was reared from a jar containing the familiar Lasioptera vits galls on grape and presumably came from this plant.

Key to species

a 5th antennal segment with a length twice its diameter; scutellum yellowish

b Antennae composed of 12 segments; femora and tibia silvery grey. Bred from boneset, Eupatorium perfoliatum.......... eupatorii n. sp., C. a1349

bb Antennae composed of 11 segments, femora and tibiae dark brown vitis n. sp., C. a1165d

aa 5th antennal segment with a length 3 times its diameter, scutellum black, legs uniform fuscous or black..............americana Felt, C. 734

LASIOPTERARIAE

This group presents a very characteristic appearance as the adults are almost invariably a dark brown and more or less ornamented with silvery white. The antennal segments are cylindric, sessile and vary greatly in number. The wings have the anterior margin thickly scaled and the first two long veins are very close to the anterior border, except in the somewhat aberrant genus Trotteria, and to a less extent in the peculiar Camptoneuromyia. A large proportion of the species breed in stem galls on woody or herbaceous plants, though the genus Baldratia exhibits a marked preference for the characteristic blister galls of certain compositae. The one Camptoneuromyia reared, C. adhesa Felt, breeds in ovate galls between adherent leaves of Solidago canadensis or S. serotina and also in a loose apical bud gall. The latter may possibly be only a modified form of the more common adherent gall. The last named is also inhabited by Asphondylia monacha O. S. The transformations in this group appear to occur invariably in the tissues of the host plant.

HOST PLANTS AND GALLS OF LASIOPTERARIAE

Achillea millefolium (yarrow)

Flowers apparently unaffected....Clinorhyncha millefolii, C. 1236

Asclepias

A. incarnata. A slight swelling at the bases of the leaves ....
Neolasioptera asclepiae, C. a1401

Aster

Blister galls
- A. paniculata
  - Oval, yellowish or brownish.....................................
    Baldratia paniculata, C. 757, a1167
- A. laevis
  - Oval, whitish..................Baldratia laeviana, C. a1287
  - Small, yellowish.....Baldratia flavomaculata, C. a1361a
  - Yellowish white, dark margined.................................
    Baldratia fuscoanulata, C. a1550, a1662
  - Purplish white blister gall.....................................
    Baldratia asterifoliae, C. a1594

Stem or branch galls
- Pustulate gall on stem....Baldratia pustulata, C. a1520
- Fusiform gall on branch..
  Neolasioptera ramuscula, C. a1361, a1397, a1500

Fusiform stem gall on Diplopappus cornifolius.............
Neolasioptera albitarsis, C. a1379, a1477

Atriplex canescens

Irregular fusiform twig gall....Lasioptera willistoni, C. a1807

Carya (hickory)

Captured...................................Trotteria caryae, C. 331

Corylus (hazel)

Captured ....Neolasioptera hamamelidis, C. 181
Captured ....Neolasioptera basalis, C. 739

Celastrus (bittersweet)

Captured ....Neolasioptera celastri, C. 598

Clematis

Ovipositing ....Neolasioptera clematidis, C. a1596a

Convolvulus sepium

Fusiform stem gall ....Lasioptera convolvuli, C. a1465

Cornus paniculata (dogwood)

Yellowish, purple margined blister gall..Lasioptera corni, C. 764, a1151

Cornus stolonifera

Irregular subcortical gall ....Neolasioptera cornicola, a1423

Crataegus (thorn)

Purplish blisterlike mine............Lasioptera excavata, C. a1576

Diervilla trifida (honeysuckle)

Bred from apparently normal twig..Lasioptera caulicola, C. a1469a

Desmodium (tick trefoil)

Irregular stem gall......Lasioptera desmodii, C. 88, a1091, a1376

Diplopappus cornifolius

Oval stem gall........Neolasioptera albitarsis, C. a1379, a1477

Ephedra trifurca

Irregular subcortical gall................Lasioptera ephedricola

Erigeron (horseweed)

Apparently normal leaf, and possibly a fusiform bud gall.................
Baldratia modesta, C. a1427, a1666a

Fusiform stem gall...
Neolasioptera erigerontis, C. a1472a, a1666

Eupatorium perfoliatum (boneset)

Oval stem gall ....Neolasioptera perfoliata, C. 1101

Bred from apparently normal flowers......................................
Clinorhyncha eupatoriflorae, C. a1689

Eupatorium ageratoides

Subglobular stem gall ....Neolasioptera eupatorii, C. a1413

Filicis (fern)

Captured........................Clinorhynchus filicis, C. 386

Fraxinus (ash)

Bred from jar containing subglobular leaf galls.........................
Lasioptera fraxinifolia, C. a1546a

Grass

Captured............................Baldratia squamosa, C. 909

Fusiform stem gall........Baldratia muhlenbergiae, C. 770, 1206

Helianthus

Bred from fusiform stem gall ....Lasioptera weldi, C. a1816

Helianthus strumosus

Bred from unrecognized gall..
Neolasioptera helianthi, C. a1718x

Hibiscus moescheutos (swamp rose mallow)

Swollen stems ....Neolasioptera hibisci, C. a1410

Humulus (hop)

Swollen stems...............Lasioptera humulicaulis, C. a1446

Ilex (black alder)

Captured.................................Lasioptera cinerea, C. 73

Impatiens (snapdragon)

Tumid leaf fold gall......Lasioptera impatientifolia, C. a1166

Lactuca (milkweed)

Irregular stem gall............Lasioptera lactucae, C. 489, 1102

Lindera (spicebush)

Irregular subcortical gall..........Lasioptera linderae, C. a1417

Liriodendron (tulip)

Captured ....Neolasioptera liriodendri, C. 291

Lycopus (bugleweed)

Fusiform stem gall..............Lasioptera mitchellae, C. a1369
Fusiform stem gall ....Lasioptera lycopi, C. a1348

Mimulus glutinosus

Stem gall ....Neolasioptera mimuli, C. 1052

Panicum macrocarpum

About to oviposit in stem................Lasioptera panici, C. 403

Pinus (pine)

Captured ....Neolasioptera flavoventris, C. 478, 480

Prunus (cherry)

Captured ....Neolasioptera sexmaculata, C. 265 ? 589
Captured on chokecherry.................Lasioptera serotina, C. 79

Rudbeckia laciniata

Bred from unrecognized gall....Lasioptera rudbeckiae C. a1697b

Quercus (oak)

Bred from flowers ....Lasioptera quericiflorae, C. 900
Captured on scrub oak.....................Trotteria tarsata, C. 667
Captured...........................Lasioptera quercina, C. 96
Subcortical twig gall..........Lasioptera querciperda, C. 1054

Rubus (blackberry)

Warty pruinose leaf gall..............Lasioptera farinosa, C. a1343
Irregular subcortical stem gall.......Lasioptera nodulosa, C. a1421

Salix (willow)

Captured..................Clinorhyncha karnerensis, C. 488

Sambucus (elder)

Irregular subcortical gall ....Neolasioptera sambuci, C. a1404

Senecio arizonensis

Irregular stem gall.............Lasioptera arizonensis, C. 1062

Silene (bouncing bet)

Captured.........................Lasioptera juvenalis, C. 703

Solanum carolinense

Irregular spiny stem gall ....Neolasioptera solani, C. 903

Solidago (goldenrod)

Bud galls

Apical, convolute..............Baldratia convoluta, C. a1307
Apical bud galls on Euthamia lanceolata.................. Lasioptera flavescens, C. a1583b

Blister galls

Oval, yellowish..................Baldratia socialis, C. a1568l
B. flavoanulata, C. a1568k
B. rubra, C. 1067
Lunate, yellowish.............Baldratia flavolunata, C. a1430
Oval, black, on Euthamia lanceolata................................ Baldratia carbonifera, C. a1354
Grayish brown, blue margined, on S. squarrosa.................. Baldratia asterifoliae, C. a1594
Rosy blister galls on S. rugosa....Baldratia rosea, C. a1474
Variegated blister gall ....Baldratia rubra, C. 650, a1586

Leaf galls

Bred from jar containing adherent type of gall made by Camptoneuromyia adhesa and Asphondylia monacha .... Lasioptera argentisquamae, C. a1568x

Stem galls

A long, uniform swelling of the stem.................................. Lasioptera cylindrigalle, C. a1408
Irregular eccentric stem swelling.Lasioptera tumifica, C. a1360
Captured.........................Baldratia abnormis, C. 676
B. albomaculata, C. 758
Lasioptera subfuscata, C. 618
L. dorsimaculata, C. 129
L. hamata, C. 280

Tilia (basswood)

Captured ....Neolasioptera tiliaginea, C. 283
Unknown stem gall...............Lasioptera spinulae, C. 1056
Stem gall on semiaquatic weed...
Lasioptera palustris, C. a1443, a1447
Stem gall ....Neolasioptera hamata, C. a1458

Vaccinium (blueberry)

Captured.......................Baldratia canadensis, C. 74

Vernonia noveboracensis (ironweed)

Bred from blossoms..........Lasioptera vernoniflorae, C. 1059

Viburnum

Captured.........................Lasioptera consobrina, C. 183a
Captured on V. acerifolium......Lasioptera viburni, C. 186
Bred from irregular subcortical gall.....................................
Neolasioptera viburnicola, C. a1409

Vitis (grape)

Tumid leaf gall...........................Lasioptera vitis, C. a1165
Petiole gall.........................Baldratia petiolicola, C. 877
Petiole gall ....Neolasioptera vitinea, C. a1415, a1065
Captured ....Lasioptera basiflava, C. 719

Zizia

Fusiform stem gall...................Lasioptera ziziae, C. a1817

Key to genera

a 1st antennal segment normal
b 3d vein very near costa and uniting therewith at or before the basal half, very rarely near the distal 3d
c Mouth parts and thorax prolonged; antennal segments 10 to 13 ....Clinorhyncha H. Lw.
cc Mouth parts and thorax not prolonged
d Palpi with 1 or 2 segments ....Baldratia Kieff.
dd Palpi with 3 or 4 segments
e 3 long veins, the 5th forked some distance from its base ....Lasioptera Meig.
ee 4 simple long veins................Neolasioptera n. g.
bb 3d vein rather strongly arched, well separated from costa, uniting therewith at the distal 3d..................Camptoneuromyia n. g.
aa 1st antennal segment produced, with a length about 3 times its diameter
b The 3d vein somewhat removed from costa and uniting therewith at the distal 3d, body thickly clothed with shining scales..............
Trotteria Kieff. (Choristoneura Rubs.)

LASIOPTERA Meig.

Members of this entire group are usually easily recognized by the thickly scaled costa, subcosta and third vein, the two latter being close to the anterior margin of the wing and the last named usually uniting therewith near the middle. It and allied genera have a characteristic coloration, usually being thickly clothed with dark brown scales and in many species the dorsum of the abdomen is conspicuously ornamented with silvery white markings, the latter being either in the form of a margin along the anterior or posterior edge of the abdominal segments or in a series of submedian spots resting upon the posterior margin of the segments. The members of this genus present a wide range in the number of antennal segments, those of the female varying from 16 in the case of L. flavescens to 33 in L. querici florae. The segments of the male antennae vary from 16 in L. lycopi to 21 or 22 in the male of L. desmodii. Some species have the same number of antennal segments in both sexes, while in the majority the female possesses two to four or five more than her consort. There seems to be no law governing this variation. Certain of the females possess a peculiar group of heavy, stout, recurved, chitinous hooks on the dorsum of the lobes of the ovipositor. This peculiar structure is present in several rather widely separated forms.

The species belonging to this genus breed for the most part in more or less irregular subcortical galls on the stems of both herbaceous and woody plants. An interesting form, L. caulicola, has been reared from apparently normal Diervilla stems. All species of this genus appear to winter in their galls. Those which live in herbaceous stems emerge, as a rule, in early spring, while the forms subsisting upon woody stems are more likely to fly during June. A few species breed in leaf galls; for instance, L. corni in an ocellate, highly colored, blisterlike gall on the leaves of Cornus alternifolia; L. vitis inhabits the common tumid leaf or tendril gall on grape, while L. impatientifolia produces a somewhat similar gall on the under side of the leaf of the snapdragon (Impatiens fulva). Blackberry leaves frequently have near the base a hard, corky, warty gall caused by L. farinosa. Lasioptera excavata has a more singular habit, since the larvae occur in a true leaf mine in the foliage of Crataegus. The galls may be monothalamous or polythalamous, some of the latter being inhabited by a considerable number of larvae, as in the case of L. cylindrigallae and L. tumifica.

Key to species

a Abdomen dark brown

b Abdomen rather thickly clothed dorsally with silvery white scales

c Antennae and mesonotum dark brown; male with 16–17 antennal segments....................On Ilex; cinerea Felt, C. 73

cc Antennae light brown; mesonotum thickly yellow scaled; antennae, female, 22 segments; bred from Solidago...................... argentisquamae n. sp., C. a1568x

bb Abdominal segments variably margined anteriorly and laterally with yellowish white scales; antennae, female, 22 segments; bred from tumid leaf or tendril gall...........vitis O. S., C. a1165, a1146

bbb Abdomen with the basal segment thickly clothed with silvery white or yellowish scales

c 2d abdominal segment fuscous yellowish; antennae, female, 15 segments; ovipositor with hooks....basiflava n. sp., C. 719

cc 2d and following abdominal segments yellow

d 3d vein uniting with costa at the basal 3d

e Female antennae with 18–19 segments; ovipositor with hooks; bred from blister gall on Cornus............... corni Felt, C. 764, a1151, a1288

dd 3d vein uniting with costa at the basal half

e Female with 23 antennal segments; no hooks present; bred from Rudbeckia........rudbeckiae n. sp., C. a1697b

ddd 3d vein uniting with costa at the distal 3d

e Female with 21 antennal segments; ovipositor with hooks; bred from apical, clavate twig gall on Cornus.......... (Cecidomyia) clavula Beutm. C. a327

ccc 2d and following abdominal segments without conspicuous white markings

d 4th and 5th abdominal segments darker than others; mesonotum dark brown; male with 19 antennal segments; bred from Impatiens leaf gall............................... impatientifolia Felt, C. a1166

dd Abdominal segments 2 to 6 unicolorous or nearly so; mesonotum reddish brown; male 18, female 20–23 segments. Bred from Vernonia flowers (? vernoniae Beutm.) vernoniflorae n. sp., C. 1058, 1059

cccc 2d and following abdominal segments with submedian silvery spots

d Subcosta uniting with costa at the basal 3d

e Mesonotum reddish brown; female with 28 antennal segments; bred from oak twigs .... querciperda n. sp., C. 1054

ee Mesonotum dark brown

f Scutellum pale orange; female with 18 antennal segments ....consobrina Felt, C. 183a

ff Scutellum purplish brown; female with 22 antennal segments ....nassauensis n. sp., C. 432

dd Subcosta uniting with the anterior margin at the basal half

e Legs and mesonotum dark brown; dorsal plate narrowly incised; male with 16 antennal segments; bred from Senecio..............a r i z o n e n s i s n. sp., C. 1062

ee Legs mostly yellowish; mesonotum dark red; dorsal plate triangularly incised; male with 17 antennal seg- ....f l a v i p e s n. sp., C. 612

eee Legs light yellowish or yellowish brown, mesonotum reddish brown, antennal segments, female 33; bred from Quercus blossoms ....q u e r c i f l o r a e n. sp., C. 900

ccccc 2d and following abdominal segments margined posteriorly with silvery white

d 3d vein uniting with costa at the basal 3d; femora and tibiae unicolorous; antennal segments, male and female, 21–22; bred from fusiform stem gall on tick trefoil; d e s m o d i i Felt, C. 88, a1091, a1376, a1291, a1184

dd 3d vein uniting with costa at the basal half

e Tarsi distinctly annulate with whitish

f Scutellum fuscous yellowish; antennal segments, female, 23; bred from Diervilla stems.............. c a u l i c o l a Felt, C. a1469a

ee Tarsi narrowly or distinctly annulate with yellowish

f Scutellum reddish brown; antennal segments, male, 19; female, 23; bred from warty leaf gall on blackberry (C e c i d o m y i a, D i p l o s i s) f a r i n o s a Beutm., C. a1343, a1331

ff Scutellum fuscous yellowish; antennal segments, male, 19; female, 22; palpi 3 segmented; bred from unknown stem gall.....s p i n u l a e n. sp., C. 1056

eee Tarsi a nearly uniform dark brown

f Scutellum dark brown; antennal segments, male, 20; female, 25; bred from irregular subcortical gall on blackberry....n o d u l o s a Beutm., C. a1421, a1411

ff Scutellum reddish brown; antennal segments, male, 20; female, 25; bred from fusiform stem gall on aquatic weed.....p a l u s t r i s Felt, C. a1443, a1447

fff Scutellum fuscous yellowish; antennal segments, male, 20; female, 23; bred from irregular subcortical stem gall on Lindera..................... l i n d e r a e Beutm., C. a1417

ffff Scutellum pale yellowish; antennal segments, male, 16; female, 21; bred from fusiform stem gall on Lycopus...........m i t c h e l l a e n. sp., C. a1369

bbbb Basal segment (sometimes margined with white) and other abdominal segments with submedian whitish spots

c 3d vein uniting with costa at the basal 3d

d Tarsi unicolorous; antennal segments, female, 19........ On Aster; d o r s i m a c u l a t a n. sp., C. 129

dd Tarsi annulate

e Tarsal segments 2 to 4 annulate basally; antennal segments, male, 17; female, 20; bred from fusiform stem gall on Convolvulus..................
convolvuli Felt, C. a1465

ee Tarsal segments 2 to 4 annulate at both extremities; antennal segments, male, 16; female, 18; bred from fusiform stem gall on Lycopus.............
lycopi Felt, C. a1348, a1339

cc 3d vein uniting with costa at the basal half

d Tarsi nearly unicolorous

e Mesonotum dark brown, the submedian lines with long, golden hairs; antennal segments, male, 21; female, 25; bred from enlarged stem gall on hop............humulicaulis Felt, C. a1445

ee Mesonotum thickly clothed with bronzy scales; antennal segments, male, 17; female, 19; bred from irregular stem gall on wild lettuce...............
lactucae Felt, C. 1102, 1061

dd Tarsi annulate

e Mesonotum black, distal palpal segment ½ longer than the preceding; antennal segments, female, 21......................hecate n. sp., C. 329

ee Mesonotum dark brown

f Distal palpal segment twice the length of the preceding; antennal segments of female, ?18; ovipositing on Panicum.....................
panici n. sp., C. 403

ff Distal palpal segment one fourth longer than the preceding; antennal segments, female, 18; bred from fusiform stem gall on Helianthus..
weldi n. sp., a1816

eee Mesonotum shining reddish brown, distal palpal segment only a little longer than the preceding; antennal segments, female, 22–23; bred from Lupine..................lupini n. sp., C. 1068

ccc 3d vein uniting with costa at the distal 3d

d Mesonotum black; antennal segments, female, 22; palpi 3 segmented; bred from subcortical twig gall on Ephedra.........................ephedricola Ckll.

dd Mesonotum dark brown

e Mesonotum unicolorous; antennal segments, female, 19; on cherry...........serotina n. sp. C. 79

ee Mesonotum distinctly bordered laterally and anteriorly with light scales

f 3d vein uniting with costa a little before the distal 3d; ventral plate long, broadly rounded apically; antennal segments, male, 15–17; female, 21–22; bred from long stem gall on Solidago...................................
cylindrigallae Felt, C. a1159, a1408

ff 3d vein uniting with costa at the distal 3d
g Ventral plate long, tapering, narrowly rounded apically; antennal segments, male, 17; female, 19–22; bred from stout, asymmetric stem gall on Solidago ....
tumifica Beutm., C. a1360, a1470, a1060
gg Ventral plate long, slender, broadly rounded apically, antennal segments, male 16, female 17; bred from stem gall on Zizia....
ziziae n. sp., a1817
bbbbb Basal and other abdominal segments white margined posteriorly
c Basal and apical white bands on fifth abdominal segment; antennal segments, male, 20; bred from subcortical twig gall on Ephedra ....ephedricola Ckll.
cc Apical band only on the 5th abdominal segment
d Femora and tibiae unicolorous; antennal segments, female, 18; on Solidago..........hamata Felt, C. 280
dd Tarsi annulate with yellowish; antennal segments, female, 23; bred from tumid leaf gall on Impatiens.....
impatientifolia Felt C. a1166
bbbbbb Abdomen with no conspicuous white markings
c 3d vein uniting with costa at the basal 3d; tarsi annulate
d Scutellum reddish brown; antennal segments, female, 25
neofusca n. sp., C. 82
dd Scutellum dark brown; antennal segments, female, 21....
juvenalis n. sp., C. 703
cc 3d vein uniting with costa at the basal half
d Scutellum dark reddish brown; antennal segments, female, 25; bred from curled ash leaves..................
fraxinifolia n. sp., C. a1546a
ccc 3d vein uniting with costa at the distal third
d Scutellum dark brown; ovipositor with chitinous hooks; antennal segments, female, 21–22......................
abhamata Felt, C. 130
aa Abdomen reddish or yellowish brown
b Mesonotum pale orange; abdomen light yellowish; antennal segments, female, 16–18; bred from Solidago.........................
flavescens n. sp., C. a1583, a1583b
bb Mesonotum slightly fuscous or dark brown
c 3d vein uniting with costa at the basal 3d
d Abdomen nearly unicolorous; antennal segments, female, 18; on oak.....................quercina Felt, C. 96
cc 3d vein uniting with costa near the basal half
d Abdomen yellowish brown; antennal segments, male, 18; on Viburnum...................viburni Felt, C. 186
dd Abdomen mostly pale orange; antennal segments, female, 26; bred from Crataegus leaf mine....................
excavata Felt, C. a1576

BALDRATIA Kieff.

This genus, as we understand it, may be easily separated from Lasioptera and its allies by the palpi having but one or two segments. The American forms breed for the most part in the peculiar, apparently fungus-infected blister galls so common on Aster and Solidago.

Key to species

a Tarsi distinctly white or yellow banded

b All tarsal segments with yellowish white bands basally, the 5th on the posterior legs yellowish; male and female with 16 antennal segments; palpi biarticulate; breeds in oval, black, blister gall on Euthamia lanceolata .... (Lasioptera) carbonifera Felt, C. a1354

bb Posterior tarsi only narrowly annulate basally with whitish; female with 22 antennal segments; palpi probably biarticulate; breeds in a rosy blister gall on Solidago rugosa................ (Lasioptera) rosea Felt, C. a1474

aa Tarsi unicolorous or nearly so

b Adbomen conspicuously yellowish in part at least

c Abdomen light fuscous yellowish; antennae with 13 segments; palpi uniarticulate; bred from Solidago........................ socialis n. sp., C. a1568 l

cc Abdomen with the basal segment fuscous yellowish; male with 12 to 14 antennal segments; palpi uniarticulate; bred from Erigeron .... (Choristoneura) modesta Felt, C. a1427, a1666, a1666a

bb Abdomen dark brown, scatteringly clothed dorsally with silvery white scales; male with 14 antennal segments; palpi uniarticulate; breeds in yellowish or brown blister galls on Aster....................... (Choristoneura) paniculata Felt, C. 757, a1167

bbb Abdomen dark brown or black

c Basal abdominal segment yellowish or silvery white

d 2d to 6th abdominal segments margined posteriorly; female antennae with 26 segments; palpi uniarticulate; bred from a grape petiole gall..........petiolicola n. sp., C. 877

dd 3d to 6th abdominal segments margined posteriorly; female antennae with 18 segments; palpi uniarticulate.............. flavoscuta n. sp., C. 1288

cc Abdominal segments with whitish submedian spots

d Segments 1 to 7 spotted

e Male antennae with 14 segments; palpi uniarticulate; bred from small pustulate gall on Aster stem.......... pustulata n. sp., C. a1520

ee Female antennae with 18 segments; palpi biarticulate; taken on Solidago .... (Choristoneura) albomaculata Felt, C. 758

dd Abdominal segments 2 to 7 spotted; female with 19 antennal segments; palpi biarticulate; bred from a purplish and white blister gall on Aster..squarrosae n. sp., C. a1594

ddd Segments 1 to to 4 spotted

e Male with 18 to 19 antennal segments; palpi biarticulate.. (Lasioptera) canadensis Felt, C. 74

dddd Segments 1 and 2 white margined posteriorly, 3 to 5 spotted; female antennae with 17 segments; palpi uniarticulate; bred from a yellowish blister gall on Aster.............. paniculata n. sp., C. a1167

ccc Abdominal segments white margined posteriorly

d Palpi uniarticulate

e Mesonotum black; male antennae with 12 to 14 segments; female with 18; palpi uniarticulate; bred from Erigeron leaf .... (Choristoneura) modesta Felt, C. a1427, a1666

ee Mesonotum dark brown; female antennae with 16 segments; palpi uniarticulate

f Posterior wing margin even; bred from yellowish blister gall on Aster.............................. flavomaculata n. sp., C. a1361a

ff Posterior wing margin distinctly emarginate at apex of 5th vein .... (Choristoneura) abnormis Felt, C. 676

dd Palpi biarticulate

e Mesonotum black; female antennae with 16 segments; bred from a dark white-ringed blister gall on Aster; fuscoanulata n. sp., C. a1550, a1662

ee Mesonotum dark brown or black; female antennae with 19 to 20 segments, male with 18; bred from a fusiform stem gall on grass.......................... (Lasioptera) muhlenbergiae Marten, C. 770, 1206

eee Mesonotum reddish brown; female antennae with 18 segments; bred from a gray, yellow margined blister gall on Solidago ... flavoanulata n. sp., C. a1568k

cccc Abdomen nearly unicolorous dorsally

d 3d vein uniting with the anterior margin near the distal 3d

e Scutellum yellowish brown, anterior tibiae yellowish; female antennae with 18 segments; palpi unicolorous; bred from Solidago..... convoluta n. sp., C. a1307

ee Scutellum reddish brown; tibiae dark brown; male antennae with 14 to 15 segments; palpi biarticulate; bred from a yellowish, brown margined blister gall on Solidago .... (Lasioptera) rubra Felt (tuberculata) C. 650, 1067, a1586

dd 3d vein uniting with the anterior margin at or near the basal half

e Tarsi yellowish; male antennae with 14 segments; palpi uniarticulate; bred from whitish blister gall on Aster laevis ....
(Choristoneura) laeviana Felt, C. a1287

ee Tarsi black

f Female antennae with 21 segments; palpi biarticulate; bred from a lunate, yellowish, marginal blister gall on Solidago ....
(Choristoneura) flavolunata Felt, C. a1430

ff Female antennae with 16 segments; palpi uniarticulate; bred from blister galls with pinkish aureola on Aster divaricata ....
divaricata n. sp., C. a1787

NEOLASIOPTERA n. g.

This genus is closely allied in general appearance and habits to Lasioptera, and is separated therefrom only by the fifth vein forking at the extreme base of the wing or by the sixth being entirely independent of the preceding [pl. 34, fig. 8]. This character, while not always determined with ease, affords a very good basis for making a division, even though this latter may not be closely correlated with variations in habit. The female antennae may be composed of from 17 segments in the case of N. celastri to 29 segments in N. viburnicola, while the males may have but 12 segments as in N. squamosa to 23 in N. cornicola. As in the genus Lasioptera, there is frequently a variation of four or five segments between the sexes and apparently following no law.

The species of this genus, as in the case of Lasioptera, breed mostly in subcortical stem galls on herbaceous and woody plants, most of the forms producing distinct enlargements, though the presence of N. hibisci is indicated only by a somewhat general enlargement of the stem. N. squamosa has been bred from grass, presumably a stem gall, while N. vitinea makes a characteristic conical gall on the grape petiole.

Key to species

a Abdomen dark brown or black

b Abdominal segments nearly unicolorous

c Tarsi dark brown; female antennal segments 17................
celastri n. sp., C. 598

bb Basal abdominal segment whitish or yellowish white
c 3d vein uniting with costa at the basal 3d
d Abdominal segments 1 to 4 white; male antennae with ?20 to 22 segments; female, 24; bred from Eragrostis........ agrostis n. sp., C. 1063
dd 3d abdominal segment margined with silvery; antennal segments, female, 25.. (Choristoneura) cinerea Felt, C. 341
ddd 2d to 4th abdominal segments with submedian lunate spots
e Tarsi mostly dark brown
f Antennal segments, female, 22; terminal lobes of ovipositor very slender (x 6).................. tenuitas n. sp., C. 1232
ff Female antennal segments, 24; male, ?20; terminal lobe of ovipositor rather stout (x 4); bred from Eragrostis ....agrostis n. sp., C. 1063
ee Tarsi mostly yellowish; terminal lobes short, stout, thickly haired..............hirsuta n. sp., C. 908
cc 3d vein uniting with costa at the basal half
d 3d and 4th basal abdominal segments yellowish or whitish
e Distal abdominal segment pale orange; antennal segments, male, 14.................................. (Choristoneura) basalis Felt, C. 739
ee Distal abdominal segments white, margined posteriorly; antennal segments, male, 20; female, 23–25; bred from conical petiole grape gall..................... (Lasioptera) vitinea Felt, C. a1415, 1065, 1118
dd 2d to 4th abdominal segments with submedian whitish spots
e Ventral plate rather broad, narrowly rounded distally; antennal segments, male, 18........................ sexmaculata n. sp., C. 265, 589
ee Ventral plate broad, narrowly incised apically; antennal segments, male, 16.. tripunctata n. sp., C. 427
ddd 2d to 3d abdominal segments margined posteriorly with silvery white
e Legs mostly pale yellowish
f Male antennal segments 18...................... (Choristoneura) liriodendri Felt, C. 291
ee Legs mostly brown
f Antennal segments, female, 23; scutellum reddish yellow; bred from irregular stem gall on Solanum .... (Choristoneura) solani Felt, C. 903
ff Antennal segments, female, 26; scutellum dark brown; presumably forming a stem gall on Clematis...................................... (Choristoneura) clematidis n. Felt. a1596a
fff Antennal segments, male, 19; female, 23; scutellum dark brown; bred from irregular subcortical gall on Sambucus .... (Cecidomyia) sambuci Felt, C. a1404

ffff Antennal segments, male, 20; female, 23–25; scutellum reddish brown; bred from conical petiole grape gall ....

(Lasioptera) vitinea Felt, C. a1415, 1065, 1118

fffff Antennal segments, female, 24; bred from fusiform stem gall on Asclepias incarnata......

asclepiae n. sp., C. a1401

ffffff Antennal segments, male, 22; female, 29; scutellum reddish brown; bred from irregular subcortical gall on Viburnum............................

(Lasioptera) viburnicola Beutm., C. a1409

dddd 3d and 4th abdominal segments margined posteriorly

e Antennal segments, male, 23; female, 27; 3d and 4th abdominal segments narrowly margined posteriorly; bred from irregular; subcortical gall on Cornus

(Lasioptera) cornicola Beutm., C. a1423, a1363

ee Antennal segments, female, 23; 3d and 4th abdominal segments broadly margined posteriorly............

(Choristoneura) hamamelidis Felt, C. 181

bbb Abdominal segments margined posteriorly with yellowish or whitish

c Tarsi banded; antennal segments, male, 18; female, 24; bred from oval stem gall on Eupatorium........................

(Choristoneura) perfoliata Felt, C. 1101

cc Tarsi unicolorous; antennal segments, female, 18; bred from Helianthus ....

(Choristoneura) helianthi Felt, C. a1718x

bbbb Basal and other abdominal segments with conspicuous submedian markings

c Submedian spots straw yellow

d Female antennal segments 18............................

flavomaculata n. sp., C. 545

cc 3d and 4th abdominal segments mostly whitish; antennal segments, male, 16; on basswood....tiliaginea n. sp., C. 283

ccc 3d and 4th abdominal segments not mostly whitish

d Tarsi unicolorous or nearly so

e Antennal segments of male, 18; female, 22; scutellum dark brown; bred from oval stem gall on tick trefoil...

(Choristoneura) hamata Felt, C. a1458

ee Antennal segments, female, 17; scutellum black..........

albolineata, n. sp., C. 1234

dd Tarsi distinctly annulate

e Antennal segments, male, 14; female, 16; palpi 3–4 segmented; scutellum dark brown; bred from fusiform bud gall on Erigeron ....

(Choristoneura) erigerontis Felt, C. a1427a, a1302, 1064

ee Antennal segments, female, 18; scutellum reddish brown; bred from stem gall on Mimulus.....................

mimuli n. sp., C. 1052

eee Antennal segments, male, 15–16; female, 23; scutellum dark brown; bred from swollen stems of Hibiscus (Choristoneura) hibisci Felt, C. a1410

eeee Antennal segments, male, 17; female, 23; scutellum dark brown; bred from oval stem gall on Eupatorium..... (Choristoneura) eupatorii Felt, C. a1413

eeeee Antennal segments, male, 19; female, 21; scutellum dark brown; bred from fusiform gall on Aster branch...... (Cecidomyia) ramuscula Beutm., C. a1361, a1397, a1500, 1107

eeeeee Antennal segments, male, 20; female, 24–25; scutellum dark brown; 4th and 5th tarsal segments on posterior legs of female white; bred from ovate stem gall on Diplopappus .... (Choristoneura) albitarsis Felt, C. a1477, a1379

aa Abdomen a pale or reddish brown

b Mesonotum light brown; antennal segments, male, 12; bred from grass..............................squamosa n. sp., C. 909

bb Mesonotum dark brown; antennal segments; female, 16–19......... flavoventris n. sp., C. 478, 480, 672

CLINORHYNCHA H. Lw.

This genus, first recognized in this country by the author, is an extremely interesting form and distinguished at once by the great prolongation of the mouth parts and the 10 to 12 segments of the antennae. The European C. chrysanthemi H. Lw. has 13 antennal segments in both sexes. The wings are also rather peculiar [pl. 34, fig. 7]. The species are all small, being only about 1 mm in length.

The European C. millefolii Wachtl. was reared from apparently normal flowers of Yarrow (Achillea millefolium) and it is probable that the other species known to occur in this country, have similar habits, particularly as all European forms, so far as known, have been bred from flowers of the Compositae.

Key to species

a 5th vein simple

b scutellum reddish brown; bred from yarrow florets................. millefolii Wachtl., C. 1236

aa 5th vein forked

b 2d to 5th abdominal segments reddish brown; captured on fern filicis Felt, C. 386

bb Abdomen a nearly uniform dark brown; taken on willow........... karnerensis n. sp., C. 488

bbb Abdomen reddish; bred from flowers of Eupatorium perfoliatum.... (Lasioptera) eupatoriflorae Felt, a1689

ÇAMPTONEUROMYIA n. g.

This genus is a very well marked type which may be recognized by the broadly oval wings having the third vein strongly arched, rather well separated from costa and uniting therewith near the distal third [pl. 34, fig. 5]. The antennae are sessile in both sexes, and the ovipositor rather short and thick. One species which has been reared breeds in ovate galls between adhering leaves of Solidago, and also in loose apical bud galls. The latter may possibly be only a modified form of the more common adherent type. The last named is also inhabited by Asphondylia monacha O. S.

Key to species

a Antennae with 15 segments

b Abdomen dark brown, scutellum fuscous yellowish; the 5th antennal segment with a length ½ greater than its diameter, male..........
(Dasyneura) virginica Felt, C. 238b

aa Antennae composed of 16 segments

b Abdomen yellowish brown, scutellum fuscous yellowish; the 5th antennal segment with a length about ¾ its diameter, female.....
fulva n. sp., C. 461

aaa Antennae with 18 segments

b Abdomen dark brown, scutellum a variable fuscous; the 5th antennal segment with a length ¼ greater than its diameter, male ....
(Dasyneura) hamamelidis Felt, C. 238a

aaaa 20 to 22 antennal segments

b Abdomen dark brown, scutellum fuscous yellowish; the 5th antennal segment of the male with a length ¼ greater than its diameter, that of the female with a length ¾ its diameter. Bred from oval, adherent gall between Solidago leaves.............................
(Dasyneura) adhesa Felt, a1568, a1583

bb Abdomen dark brown, the basal and distal segments yellowish; male, 21, female 22 antennal segments, the 5th in both sexes with a length ¼ greater than its diameter. Bred from marginal leaf roll on high blackberry........................rubifolia n. sp., a1866

TROTTERIA Kieff.

Choristoneura Rubs.

Members of this genus are easily recognized by their abundant scale covering and the peculiar character of the wings [pl. 34, fig. 3]. Costa to the apex of the wing, subcosta and the third vein are heavily scaled, the latter curving out distinctly from the nearly straight costa and uniting therewith near the distal third. The antennae are likewise peculiar to the genus, the first segment being greatly produced [fig. 32] and having a length about three

times its greatest diameter. The other segments are sessile, cylindric and in most species have a length ½ or ¾ that of the diameter; the number of segments may range from 16 to 22. The femora are strongly swollen and the tibiae, particularly the posterior pair, armed with long, setose spines which, in some

Fig. 32. Trotteria subfuscata n. sp., basal antennal segments, much enlarged. (Original)

forms, extend to the base of the second tarsal segment. The male genitalia present a very characteristic type, differing in certain respects markedly from those of other Cecidomyiidae.

Key to species

a Females
- *b* 16 antennal segments; abdomen dark brown..................... karnerensis n. sp., C. 484
- *bb* 20 antennal segments; abdomen dark brown......................... subfuscata n. sp., C. 618
- *bbb* 22 antennal segments
  - *c* Claws stout; legs thickly clothed with scales. Bred from Solidago solidaginis n. sp., C. a1568y
  - *cc* Claws rather slender; legs rather thinly clothed with scales.... caudata n. sp., C. 477

aa Males
- *b* 18 antennal segments; abdomen thickly clothed with silvery scales.. squamosa n. sp., C. 522
- *bb* 20 antennal segments
  - *c* 5th antennal segment with a length more than ¾ its diameter ... (Choristoneura) caryae Felt, C. 334
  - *cc* 5th antennal segment with a length scarcely ¾ its diameter
    - *d* Abdomen silvery white; tibiae dark fuscous orange .... argenti n. sp., C. 466
    - *dd* Abdomen silvery yellow; tibiae and tarsi black .... tarsata n. sp., C. 667
    - *ddd* Abdomen pale brown; tibiae dark brown................... metallica n. sp., C. 335

DASYNEURIARIAE

Species belonging in this tribe may be recognized by the dentate claws, by the 3d vein being well separated from costa [pl. 35],

and by the antennal segments being almost invariably stalked in the males.

A large number of forms are referable to this group, the two important genera being Dasyneura and Rhabdophaga. The former are medium sized, usually brownish or yellowish. The insects breed very largely in leaf folds, leaf buds or loose leafy bud galls. The genus Rhabdophaga comprises a number of larger, usually reddish or reddish brown forms, which display a marked preference for woody tissues, a considerable number of species living in willow galls. The genus Arnoldia represents a number of forms having 12 segmented antennae. One form breeds in the tumid vitis gall on grape, while several others which were reared probably came from decaying vegetable matter. The peculiar, synthetic Diarthronomyia artemisiae is a western form and was reared from galls on sage bush.

HOST PLANTS AND GALLS OF DASYNEURIARIAE

Abies (spruce)

Seeds............................Dasyneura canadensis, a1428

Agrostis vulgaris (Red top or June grass)

Ovipositing on......................Dasyneura graminis, C. 1209

Alnus (alder)

Bud gall.............................Dasyneura serrulatae O. S.

Anemone canadense

Loose bud gall.......................Dasyneura anemone, a1522

Artemisia tridentata (sage bush)

Stem ? gall................Diarthronomyia artemisiae, C. 989

Cephalanthus (button bush)

Twig gall...................Rhabdophaga cephalanthi, C. 1048

Clematis virginiana (virgin's bower)

Oval stem gall.....................Dasyneura clematidis, a1659

Corylus (hazel)

Hairy leaf fold..........................Dasyneura coryli, a1543

Crataegus (wild thorn)

Cockscomb leaf gall? ....Arnoldia absobrina, a1555x

Eupatorium purpureum (Joe pye weed)

Blossoms............................Dasyneura purpurea, a1693a

Fraxinus (ash)

Tumid leaf gall ?..................Dasyneura tumidosae, a1532
Curled leaves.....................Arnoldia fraxinifolia, a1572a
Rolled leaves....................Dasyneura fraxinifolia, a1648a
Head of deformed leaves..............Dasyneura apicatus, a1712

Galium (bed straw)

Flower buds..............................Dasyneura galii, a1678k

Gleditschia (honey locust)

Folded leaflets ....Dasyneura gleditschiae O. S., C. 958

Lepidium (pepper grass)

Dasyneura lepidii, C. 1035

Lysimachia (loosestrife)

Loose bud galls ....Dasyneura lysimachiae Beutm., a1192

Piperita (peppermint)

Loose bud gall......................Dasyneura piperitae, a1663a

Populus (poplar)

Twigs bearing white cocoons........Rhabdophaga populi, C. 78x

Quercus (oak)

Acorns............................Dasyneura glandis, C. 1030

Rhus (sumac)

Root galls...................................Dasyneura rhois Coq.

Robinia (common locust)

Folded leaflets.............Dasyneura pseudacaciae Fitch, a1355

Rosa (rose)

Curled leaves ....Dasyneura ? rosarum Hardy, a1491
Rose buds..................Dasyneura rhodophaga Coq., a1390
Large rosette bud gall ....Rhabdophaga rosacea, C. 1244

Rubus (blackberry)

Blossoms........................Dasyneura rubiflorae, C. 990

Salix (willow)

Curled leaves........................Dasyneura salicifolia, a1675
Rolled leaves...................Rhabdophaga plicata, C. 1037
Bud galls
Small rosette gall..............Rhabdophaga racemi, C. 1245
Small rosette gall........Rhabdophaga normaniana, C. 1246
Large, loose rosette gall....Rhabdophaga rhodoides, C. 1247
Large, open rosette gall..
Rhabdophaga brassicoides Walsh, a1173
Large, close rosette (pine cone) gall ....
Rhabdophaga strobiloides Walsh, a1443
Large, close rosette (pine cone) gall.................................
Rhabdophaga persimilis, a1811
Large, close rosette (pine cone) gall.................................
Rhabdophaga albovittata Walsh, a1442a, a1433a
Small bud galls................Dasyneura californica, C. 981
Small bud galls.................Rhabdophaga gemmae, C. 254
Twig galls
Apical, elongate, beaked (rigidae) gall..............................
Rhabdophaga sodalitatis, a1074b
Swollen twig with massed buds (Triticoides and Hordeoides gall of Walsh)........Rhabdophaga triticoides, a1078x, a1073x
Nodular gall at base of twig ....
Rhabdophaga nodula Walsh, a1412
Subglobular, lateral gall........Rhabdophaga globosa, a1084a
Irregular ovoid or globular galls......................................
Rhabdophaga batatas Walsh, a686, a1102, a1108
Irregular, elongate swelling ....
Rhabdophaga salicis Schrank, a1356
Inconspicuous knotted gall..Rhabdophaga latipennis, C. 782
Slight swelling of branch ....
Rhabdophaga podagrae, a1399, a1076y
Twig hardly enlarged.......Rhabdophaga ramuscula, a1449a

Solidago (golden rod)

Blister gall ?.......................Dasyneura carbonaria, C. 713
Loose pod of adherent terminal leaves..Dasyneura folliculi, a1581

Spiraea (meadow sweet)

Tumid leaf fold.....................Dasyneura salicifolia, a1675
Rhabdophaga salicifolia, C. 1045, a1505

Trifolium (clover)

Folded leaves...................Dasyneura trifolii, C. 456m, 742
Flower heads....Dasyneura leguminicola Lintn., C. 134, a1695

Ulmus (elm)

Bud gall.................................Dasyneura ulmea, C. 880

Vaccinium (cranberry)

Leaf fold gall..................Dasyneura vaccinii Smith, C. 957

Vitis (grape)

Tumid leaf gall..........................Dasyneura vitis, a1165b
Tumid leaf gall...........................Arnoldia vitis, a1165a

Wood, decaying

Fungus filled....................Dasyneura flavotibialis, a1454

Yucca

Dasyneura yuccae, C. 1053

Key to genera

a Palpi biarticulate...............................Diarthronomyia n. g.
aa Palpi quadriarticulate
  b Antennae with 12 segments..........................Arnoldia Kieff.
  bb Antennae usually with more than 12 segments
    c 3d vein uniting with costa distinctly before the wing apex, straight or curved anteriorly and tapering but little distally....Dasyneura Rond.
    cc 3d vein uniting with costa very near or at the wing apex, straight and usually tapering distally.....................Rhabdophaga Westw.

DIARTHRONOMYIA n. g.

This genus presents a general resemblance to Rhopalomyia and like it has biarticulate palps and a great similarity in the structure of the male genitalia. The minutely unidentate claws associate it with Rhabdophaga and its allies. The wing is illustrated on plate 34, figure 9.

Type D. artemisiae

Diarthronomyia artemisiae n. sp.

Male. Length 2 mm. Antennae nearly as long as the body, rather thickly haired, yellowish brown, 18 segments; mesonotum dark reddish brown, the submedian lines sparsely haired; scutellum reddish brown, postscutellum darker; abdomen sparsely haired, reddish brown; halteres yellowish transparent; legs a variable light straw, lighter distally.

Female. Length 3 mm. Antennae extending to the 3d abdominal segment, sparsely haired, pale yellowish, probably composed of 18 segments; color characters about as in the opposite sex.

Described from several specimens bred June 16, 1883, from sage bush, Artemisia tridentata, at Fort Garland, Col. This species may possibly be identical with the Rhabdophaga tridentatae Rubs. which was bred from this plant, though this last named form is credited with having but 16 antennal segments and the stem being but ½ the length of the basal enlargement, whereas in the form under consideration the stem is at least ¾ the length of the basal enlargement.

Type C. 989, U. S. National Museum 3120

ARNOLDIA Kieff.

Males

a Stem of antennal segment about ¼ longer than the basal enlargement
- *b* Abdomen pale orange, palp 2 segmented, ventral plate broadly and roundly emarginate, dorsal plate broad and roundly emarginate . . ungulata Felt, C. 1221
- *bb* Abdomen pale brown, palp 4 segmented, ventral plate slightly emarginate, dorsal plate triangularly emarginate .... hispida Felt, C. 519
- *bbb* Abdomen dark yellowish fuscous, palp 4 segmented, ventral plate emarginate distally, dorsal plate slightly emarginate .... (Dasyneura) cerasi Felt, C. 343

aa Stem of antennal segment about as long as the basal enlargement
- *b* Abdomen yellowish brown, palp 3 segmented, ventral plate broadly rounded..................................vitis Felt, C. a1165a
- *bb* Abdomen reddish yellow, tibiae and tarsi dark brown, palp 3 segmented, ventral plate roundly emarginate....................... absobrina Felt, C. a1555x
- *bbb* Abdomen light yellowish or yellowish orange, tibiae fuscous straw, tarsi dark brown or black, palp 4 segmented, ventral plate roundly emarginate......................fraxinifolia Felt, C. a1572a

aaa Stem of antennal segment ¾ the length of the basal enlargement
- *b* Abdomen dark brown, palp 5 segmented, dorsal plate triangularly incised.......................................minor Felt, C. 431

Females

a Abdomen pale yellowish, 5th antennal segment with a length about thrice its diameter, palp 3 segmented.........absobrina Felt, C. a1555x

aa Abdomen light fuscous yellow, 5th antennal segment with a length about 2½ times its diameter, palp 4 segmented........vitis Felt, C. a1165a

DASYNEURA Rond.

This genus comprises a large number of medium and rather small usually dark brown insects which breed by preference in leafy tissue. This group intergrades with Rhabdophaga and the

more typical forms may be distinguished therefrom by the heavy, nearly uniform 3d vein uniting with the margin well before the apex of the wing [pl. 35, fig. 3, 6].

Key to species

a 3d vein distinctly curved anteriorly [pl. 35, fig. 2, 6]

b 9 antennal segments, abdomen yellowish, bred from rose (Neocerata) rhodophaga Coq., a1390

bb 10 antennal segments, females

c Abdomen reddish salmon, scutellum pale yellowish, tibiae yellowish basally; 5th antennal segment with a length three times its diameter. Bred from decaying wood ....flavotibialis Felt, a1454

cc Abdomen pale yellowish, scutellum reddish brown; 5th antennal segment with a length twice its diameter.. maculosa n. sp., C. 288

bbb 11 antennal segments

c Antennal stem ¾ the length of the basal enlargement, male

d Abdomen yellowish red, scutellum reddish yellow, tibiae yellowish basally; bred from decaying wood............flavotibialis Felt, a1454

bbbb 12 antennal segments, sessile or subsessile

c Abdomen and scutellum deep carmine; 5th antennal segment with a length twice its diameter; palpi long, slender; lobes of the ovipositor with a length 3 times their width, female; bred from Solidago............. carbonaria Felt, C. 713

cc Abdomen and scutellum dark reddish brown; 5th antennal segment with a length ½ greater than its diameter; palpi rather short, stout; lobes of the ovipositor with a length about 4 times their width, female. Taken on New England tea..vernalis n. sp., C. 262

ccc Abdomen dark reddish salmon, scutellum red, male.... bidentata Felt, C. 345

bbbbb 13 antennal segments, sessile or subsessile

c Females

d Abdomen fuscous yellowish, unicolorous, scutellum light reddish brown, bred from ash............ fraxinifolia Felt, a1648a

dd Abdomen fuscous yellowish basally, yellowish apically; scutellum fuscous yellowish; bred from tumid gall on grape......vitis n. sp., a1165b

ddd Abdomen dark red, scutellum reddish brown... karnerensis n. sp., C. 128

dddd Abdomen and scutellum reddish brown......... spiraeina n. sp., C. 133

ddddd Abdomen dark orange, scutellum brown; taken ovipositing in June grass...................... graminis n. sp., C. 1209

bbbbbb 14 antennal segments

c Females, antennal segments sessile

d Abdomen yellowish or yellowish orange

e Ovipositor long

f Abdomen light yellowish, scutellum pale yellowish; 5th antennal segment with a length ½ greater than its diameter; terminal lobes of ovipositor long, nearly oval, hardly tapering distally. Bred from loose bud gall on peppermint.... piperitae n. sp., a1663a

ff Abdomen light yellowish red, scutellum yellowish carmine; the 5th antennal segment with a length ½ longer than its diameter; lobes of the ovipositor long and tapering distally................. borealis Felt, C. 160

fff Abdomen yellowish brown, scutellum reddish brown; 5th antennal segment with a length twice its diameter; terminal antennal segment much produced, the 3d and 4th palpal segments equal; terminal lobes of the ovipositor long, slender and narrowly oval. Bred from acorns.... glandis n. sp., C. 1030

ee Ovipositor short

f Body a pale lemon-yellow; 5th antennal segment with a length 2½ times its diameter; 4th palpal segment ½ longer than 3d; lobes of ovipositor small, roundly quadrate. Bred from hairy leaf fold on Corylus..coryli Felt, a1543

ff Abdomen pale fuscous orange; 5th antennal segment with a length 2½ times its diameter; 3d and 4th palpal segments equal; lobes of ovipositor rather broadly oval.................................. (Asphondylia) carpini Felt, C. 346

dd Abdomen dark brown

e Ovipositor long

f Scutellum fuscous red; 5th antennal segment with a length twice its diameter, tapering distally; 3d and 4th palpal segments equal...................... aurihirta n. sp., C. 509

ff Scutellum reddish brown; 5th antennal segment with a length 1/3 greater than its diameter ....
photophila Felt, C. 193, 194, 586

fff Scutellum yellowish brown; 5th antennal segment 1/3 longer than its diameter. Bred from blackberry blossom ....
rubiflorae n. sp., C. 990

ffff Incisures and pleurae yellowish, tibiae and tarsi dark brown; 5th antennal segment with a length twice its diameter. Bred from loose bud gall on Anemone.......
anemone Felt, a1522

ee Ovipositor short ....

f Abdomen dark brown, scutellum brown, incisures fuscous yellowish; 5th antennal segment with a length about 1/2 greater than its diameter..............
brevicauda n. sp., C. 340, 437, 501

cc Males, antennal segments stemmed....................

d 5th antennal segment with a stem 1/3 the length of the basal enlargement........................

e Abdomen dark brown, scutellum yellowish..
photophila Felt, C. 194

ee Abdomen yellowish brown, scutellum pale yellowish. Bred from Yucca............
yuccae n. sp., C. 1053

dd Antennal stem with a length 3/4 the basal enlargement

e Abdomen fuscous yellowish, unicolorous; dorsal plate, deeply and triangularly incised.
fraxinifolia Felt, a1648a

ee Abdomen fuscous yellowish basally and apically, middle segment dark brown; dorsal plate narrowly incised ....
ampelophila n. sp., C. 449

eee Abdomen light brown, scutellum yellowish brown. Bred from blackberry blossom....
rubiflorae n. sp., C. 990

eeee Abdomen dark brown

f The basal enlargement of the 5th antennal segment with a length twice its diameter; the terminal segments with a distinct process..setosa Felt, C. 750

ff The basal enlargement of the 5th antennal segment with a length 1/2 greater than its diameter, the terminal segment narrowly oval with the apical process rudimentary or wanting; palp rather slender; basal tooth of claw very long

g Basal clasp segment stout with a length 3 times its diameter, tapering distally .... unguicula Felt, C. 1225

gg Basal clasp segment slender with a length 4 times its diameter, hardly tapering distally .... pudorosa n. sp., C. 279

fff The basal enlargement of the 5th antennal segment with a length ¼ greater than its diameter; palp rather stout; basal tooth of the claw shorter..... simulator n. sp. C. 445, 627

ddd 5th antennal segment with the stem as long as the basal enlargement

e Abdomen dark orange, scutellum pale yellowish; the basal enlargement of the 5th antennal segment with a length 2½ times its diameter; the circumfili heavy and very irregular. Bred from hairy leaf fold gall of Corylus..............coryli Felt, a1543

bbbbbbb 15 antennal segments

c Females, segments sessile

d Abdomen dark brown, scutellum reddish brown; ovipositor not longer than the body, the lobes with a length about 5 times their width...... ? trifolii Loew, C. 456, 742

dd Abdomen dark brown, scutellum brownish red; ovipositor distinctly shorter than the body, the lobes with a length about 3 times the diameter. Bred from apical bud gall on blueberry...... cyanococci Felt, a1700

ddd Abdomen pale yellowish, scutellum pale orange; 5th antennal segment with a length about ½ greater than its diameter .... flavescens n. sp., C. 601

cc Males, antennal segments stemmed

d 5th antennal segment with the stem ½ the length of the basal enlargement

e Abdomen light fuscous yellowish, scutellum pale orange. Bred from Clematis........ clematidis n. sp., a1659

dd 5th antennal segment with the stem ¾ the length of basal enlargement

e Abdomen yellowish red, scutellum yellowish; basal enlargement of the 5th antennal segment with a length ¼ greater than its diameter, the 15th produced and with a length 3 times its diameter .... filicis Felt, C. 43

ee Abdomen dark brown; basal enlargement of 5th antennal segment with a length ½ greater than its diameter, the 15th not produced, nearly oval. Bred from loose apical bud gall on Anemone .... anemone Felt, a1522

bbbbbbbb 16 antennal segments

c Females, antennal segments sessile

d Abdomen dark brown, scutellum reddish orange; 5th antennal segment with a length ½ greater than its diameter............................ flavicornis n. sp., a1154

dd Abdomen reddish or light brown

e Abdomen reddish brown, scutellum fuscous yellowish; the 5th antennal segment with a length twice its diameter. Bred from leaf gall on cranberry. vaccinii Smith, C. 957

ee Abdomen light brown, scutellum dark red; 5th antennal segment with a length ½ greater than its diameter. modesta n. sp., C. 1200

ddd Abdomen yellowish

e Abdomen and scutellum pale yellowish. Bred from ash......... apicatus n. sp., a1712

ee Abdomen fuscous yellowish, scutellum light fuscous yellowish. Bred from Clematis... clematidis n. sp., a1659

cc Antennal segments stemmed

d 5th antennal segment with a stem ¼ the length of the basal enlargement

e Abdomen yellowish red, scutellum yellowish red; 5th antennal segment with a length 2½ times its diameter, female .... caricis Felt, C. 111

dd 5th antennal segment with a stem ¾ the length of the basal enlargement, males

e Abdomen dark brown, scutellum reddish brown quercina Felt, C. 47

ddd 5th antennal segment with a stem as long as the basal enlargement, males

e Abdomen reddish brown, scutellum fuscous yellowish. Bred from leaf gall on cranberry vaccinii Smith, C. 957

dddd 5th antennal segment with a length 1¼ that of the basal enlargement, males

e Abdomen yellowish brown, scutellum reddish brown ....caricis Felt, C. 110

bbbbbbbbb 17 antennal segments

c Female, antennal segments sessile

d Abdomen reddish brown, scutellum fuscous yellowish; 5th antennal segment with a length ¼ greater than its diameter; ovipositor ⅔ the length of the abdomen, terminal lobes short and broad. Bred from Lepidium........l e p i d i i n. sp., C. 1035

cc Males, 5th antennal segment with the stem ½ the length of the basal enlargement

d Abdomen pale yellowish, scutellum reddish brown; bred presumably from the common tumid midrib gall on ash.........t u m i d o s a e n. sp., a1532

bbbbbbbbbb 18 antennal segments

c Females, antennal segments sessile

d Abdomen pale reddish brown, scutellum dull brown; the 5th antennal segment with a length ½ greater than its diameter..............................
m u l t i a n u l a t a n. sp., C. 261

dd Abdomen dark reddish brown, scutellum yellowish brown, ovipositor short, the terminal lobes very short and broad.......f l o r i d a n. sp., C. 1057

aa 3d vein straight or nearly so [pl. 35, fig. 3]

b Antennal segments 11, sessile, the 5th with a length ½ greater than its diameter, male......a b e r r a t a n. sp., C. 1200a

bb Abdomen fuscous yellowish, scutellum reddish brown, segments cylindric, sessile, with a length ½ greater than the diameter, female...............c i r s i o n i n. sp., C. 619

bbb 13 antennal segments

c Females, antennal segments sessile

d Antennal segments cylindric or nearly so

e Abdomen dark brown, scutellum black; the 5th antennal segment with a length twice its diameter...........s c u t a t a n. sp., C. 507

ee Abdomen dark brown, scutellum reddish brown; 5th antennal segment with a length ¼ greater than its diameter..............
a c e r i f o l i a Felt, C. 66

eee Abdomen light brown, scutellum dark brown; 5th antennal segment with a length ½ greater than its diameter. The legs shorter and stouter than in D. s c u t a t a........
a l b o h i r t a n. sp., C. 44

eeee Abdomen reddish brown, scutellum brown; the 5th antennal segment with a length twice its diameter........s i m i l i s n. sp., C. 596

eeeee Abdomen yellow, thorax tinged with red. Bred from root gall on Rhus..[1]r h o i s Coq.

dd Antennal segments more or less oval

[1] Location provisional.

e Abdomen dark brown, scutellum reddish brown; the 5th antennal segment with a length ½ greater than its diameter; 4th palpal segment twice the length of the 3d.. a n t e n n a t a n. sp., C. 213

ee Abdomen pale salmon, scutellum fuscous yellowish; 5th antennal segment with a length twice its diameter; the 3d and 4th palpal segments equal..c a n a d e n s i s Felt, a1428

bbbb 14 antennal segments

d Females, antennal segments sessile

e Abdomen dark brown; 5th antennal segment with a length ¼ greater than its diameter . . ..

f Scutellum yellowish brown; 5th tarsal segment stout with a length only twice its diameter. Lobes of the ovipositor stout with a length about 2½ times their width, and tapering distally to the narrowly rounded apex. Bred from leaves of honey locust, Gleditschia .... g l e d i t s c h i a e O. S., C. 958

ff Scutellum dark brown, 5th tarsal segment with a length 3 times its diameter; lobes of the ovipositor long, with a length about 3 times their width and tapering but slightly. Bred from leaves of locust, Robinia .... p s e u d a c a c i a e Fitch, a1355

ee Abdomen light or reddish brown

f Abdomen reddish brown; the 5th antennal segment cylindric with a length ½ greater than its diameter; palpi quadriarticulate. Bred from bud gall on Salix................. c a l i f o r n i c a n. sp., C. 981

ff Abdomen light brown, antennal segments ovate, the 5th with a length about ½ greater than its diameter; palpi triarticulate. Bred from Lupinus..? l e g u m i n i c o l a C. 1034

eee Abdomen dark carmine, scutellum yellowish; the 5th antennal segment oval, with a length about twice its diameter; palpi quadriarticulate, short, stout........................ d e n t i c u l a t a Felt, C. 156

eeee Abdomen reddish orange, scutellum dark brown; the 5th antennal segment with a length ½ greater than its diameter; palpi long, the 4th segment being ¾ longer than the 3d..........augusta n. sp., C. 737

dd Antennal segments with a stem ¼ the length of the basal enlargement

e Abdomen dark brown, scutellum fuscous yellowish, length 2.25 mm, female. Bred from rose ....? rosarum Hardy, a1491

ddd Antennal stem ⅓ the length of the basal enlargement, male

e Abdomen brown, scutellum dark brown...... acerifolia Felt, C. 72

dddd Antennal stem ½ the length of the basal enlargement, male

e Abdomen and scutellum dark brown. Bred from locust, Robinia...................... pseudacaciae Fitch, a1355

ddddd Antennal stem as long as the basal enlargement, male

e Abdomen reddish brown, scutellum fuscous brown; 4th palpal segment a little shorter than the 3d. Bred from folded leaves of white clover..............trifolii Loew

bbbbb 15 antennal segments

c Antennal segments sessile, female

d Abdomen dark reddish

e Scutellum fuscous yellowish; 5th antennal segment with a length twice its diameter

f 4th palpal segment with a length only ¼ greater than the 3d. Bred from bed straw, Galium................. galii n. sp., a1678k

ee Scutellum fuscous orange; 5th antennal segment tapering distally with a length 2½ times its diameter. Bred from Solidago.. folliculi n. sp., a1581

eee Scutellum fuscous yellowish, the 5th antennal segment with a length 2½ times its diameter ? trifolii Loew

dd Abdomen dark brown, scutellum yellowish and fuscous; 5th antennal segment with a length twice its diameter; 4th palpal segment ½ longer than the 3d. Bred from willow, Salix...... salicifolia Felt, a1675

ddd Abdomen dull orange-yellow, scutellum dark red; 5th antennal segment with a length 2½ times its diameter; 4th palpal segment ½ longer than the 3d..................f u l v a n. sp., C. 257

cc Antennal segments stemmed, male

d 5th antennal segment with a stem ½ the length of the basal enlargement

e Abdomen brownish black, genitalia yellow. Bred from root gall on Rhus............ [1]r h o i s Coq.

dd 5th antennal segment with a stem as long as the basal enlargement

e Abdomen yellowish red. Taken on clover.. ? l e g u m i n i c o l a Lintn., a1695, C. 1034

bbbbbb 16 antennal segments

c Antennal segments sessile, female

d Abdomen dark brown

e Scutellum fuscous yellowish; 5th antennal segment with a length ½ greater than its diameter; 4th palpal segment ½ longer than the 3d. Bred from bud gall on elm...... u l m e a n. sp., C. 880

ee Scutellum yellowish brown

f Antennal segments cylindric, the 5th with a length about 2½ times its diameter, the ovipositor longer than the body, the lobes with a length about 3½ times their breadth. Taken on clover .... ? l e g u m i n i c o l a Lintn., C. 105, 114, 134, 740

ff Antennal segments slightly oval, the 5th with a length ¾ greater than its diameter; the ovipositor longer than the body, the lobes having a length four times their breadth.... r u f i p e d a l i s n. sp., C. 127

eee Scutellum pale fuscous orange; 5th antennal segment with a length twice its diameter. Bred from blossoms of Joe pye weed..... p u r p u r e a n. sp., a 1693a

dd Abdomen brown, scutellum dull red; 5th antennal segment with a length twice its diameter. Bred from Lysimachia .... l y s i m a c h i a e Beutm., a1192

[1] Location provisional.

ddd Abdomen yellowish orange, scutellum yellowish white; 5th antennal segment with a length twice its diameter............................
flavoabdominalis n. sp., C. 738

cc Antennal segments stemmed, males

d 5th antennal segment with a stem as long as the basal enlargement

e Abdomen dark brown; 5th antennal segment with the enlargement ¼ longer than its diameter. Bred from willow, Salix.......
salicifolia Felt, a1675

ee Abdomen and scutellum reddish brown; taken on clover............................
?leguminicola Lintn., C. 125, 457

eee Abdomen brown, scutellum dull red. Bred from loose bud gall on Lysimachia.........
lysimachiae Beutm., a1192

dd 5th antennal segment with the stem ¼ longer than the basal enlargment

e Abdomen dark reddish orange, scutellum brown......attenuata n. sp., C. 1209b

bbbbbbb 17 antennal segments

d Antennal segments sessile, females

e Abdomen reddish brown, scutellum yellowish; 5th antennal segment with a length 2¼ times its diameter..........................
flavoscuta Felt, C. 553

ee Abdomen blood red, scutellum pale yellowish; 5th antennal segment with a length 2¼ times its diameter. Bred from Lysimachia
lysimachiae Beutm., C. 1240

eee Abdomen fuscous orange, scutellum brownish orange; 5th antennal segment with a length twice its diameter........................
consobrina Felt, C. 215

cc Antennal segments stemmed, males

d 5th antennal segment with a stem ¾ the length of the basal enlargement

e Abdomen dark brown, scutellum reddish brown..........melilotii Felt, C. 744

dd 5th antennal segment with a stem as long as the basal enlargement

e Abdomen pale salmon, scutellum yellowish orange. Bred from spruce seeds........
canadensis Felt, a1428

ddd 5th antennal segment with a stem ¼ longer than the basal enlargement

e Abdomen dark brown, scutellum reddish brown...........pedalis n. sp., C. 410

bbbbbbbb 18 antennal segments

c Abdomen red, antennal segments with the stem as long as the basal enlargement in the male, sessile in the female. Bred from an apical bud gall on alder......
[1]serrulatae O. S.

RHABDOPHAGA Westw.

This genus comprises a number of large, usually reddish brown forms breeding mostly in woody galls, particularly those on willow. It intergrades with Dasyneura and the more typical members may be distinguished by the usually tapering 3d vein uniting with the margin at or very near the apex of the wing [pl. 35, fig. 1].

Key to species

a 14 antennal segments

b Segments sessile; abdomen reddish brown; claws rather stout. Bred apparently from a Rigidae gall..........................
sodalitatis n. sp., a1074b

aa 15 to 17 antennal segments

b Females; antennae short, segments sessile

c 3d vein uniting with the costa at the apex; the ovipositor shorter than the body

d 17 antennal segments, the 5th with a length twice its diameter; the 4th palpal segment ¼ longer than the 3d; the lobes of the ovipositor with a length 3 times the width. Bred from Triticoides and Hordeoides galls of Walsh ....
triticoides Walsh, a1087x, a1073x

dd 16 antennal segments, the 5th with a length twice its diameter, tapering distally; the 4th palpal segment with a length ½ greater than its diameter; the lobes of the ovipositor with a length 3½ times their width. Bred from an apparently typical Strobiloides gall....
persimilis n. sp., a1811

ddd 15 antennal segments

e 5th antennal segment with a length ½ greater than its diameter; ovipositor lobe with a length ¼ greater than its width; abdomen dark red, yellowish basally. Bred from nodular gall at base of willow twigs........nodula Walsh, a1412

ee 5th antennal segment with a length 2½ times its diameter; ovipositor lobe with a length 3 times its width; the 3d and 4th palpal segments equal. Bred from willow twig........................
ramuscula n. sp., a1449a ? C. 1242

cc 3d vein uniting with the costa a little before the apex; ovipositor long

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[1] Location provisional.

d 15 antennal segments

e 5th antennal segment with a length ½ greater than its diameter

f 15th antennal segment slightly extended, with a length only 3 times its diameter, the 4th palpal segment ½ longer than the 3d. Bred from rolled willow leaves................. plicata n. sp., C. 1037

ee 5th antennal segment with a length twice its diameter

f 15th antennal segment reduced; the 4th palpal segment ¼ longer than the 3d; the ovipositor lobe with a length 3 times its width. Bred from a Strobiloides gall.............. ? albovittata Walsh, a1442a, a1433a

ff 15th antennal segment extended, with a length fully 5 times its diameter; 3d and 4th palpal segments equal; ovipositor lobe with a length 4 times its diameter. Bred from small, clustered, rosette bud galls on willow racemi n. sp., C. 1245

dd 17 antennal segments

e Wings broad; 5th antennal segment with a length ½ greater than its diameter; 4th palpal segment with a length twice that of the 3d; ovipositor lobe with a length 2½ times its diameter marginata n. sp., C. 81

ee Wings narrow; 5th antennal segment with a length twice its diameter; the 4th palpal segment ¼ longer than the 3d; ovipositor lobe with a length 3 times its width. Bred from irregular twig gall on willow...salicis Schrank, a1356

bb Males; antennal segments stemmed

c 5th antennal segments with a length ½ that of the basal enlargement

d Antennae slender, the basal enlargement of the 5th segment with a length twice its diameter; the palpi slender, the 4th ¼ longer than the 3d; harpes with a long chitinous process apically. Bred from willow twig....................ramuscula n. sp., a1449a

dd Antennae stout, the basal enlargement of the 5th segment with a length ½ greater than its diameter; the 3d and 4th palpal segments equal; harpes without long chitinous processes apically. Bred from a nodular gall at the base of willow twig................. nodula Walsh, a1412, C. 779

cc 5th antennal segment with a length ¾ that of the basal enlargement

d Antennae nearly as long as the body

e The basal enlargement of the 5th antennal segment with a length twice that of its diameter

f Wings broad, with a length only about ½ greater than the width

g 16 antennal segments; the 3d and 4th palpal segments equal. Bred from an inconspicuous knotted gall on willow.. l a t i p e n n i s n. sp., C. 782

ff Wings slender, with a length about 2½ times their width

g Claws strongly curved, the basal tooth long

h 17 antennal segments, the basal enlargement of the 5th with a length 2½ times its diameter; the 4th palpal segment ¼ longer than the 3d. Bred from irregular stem gall on willow........................ s a l i c i s Schrank, a1356

gg Claws long, slightly curved, the basal tooth small

h 17 antennal segments, the basal enlargement of the 5th ovate, with a length twice its diameter.......... c a l i f o r n i c a n. sp., C. 1012

hh 18 antennal segments, the 5th having the basal enlargement cylindric, with a length 2½ times its diameter o c c i d e n t a l i s n. sp., C. 1073

ee Basal enlargement of the 5th antennal segment with a length only ½ greater than its diameter

f 16 antennal segments; bred from a Triticoides and Hordeoides gall of Walsh .... t r i t i c o i d e s Walsh, a1076, a1087c

dd Antennae about ⅔ the length of the body

e Subcosta uniting with the margin just before the basal half

f 16 antennal segments, the 5th having the basal enlargement with a length twice its diameter; the 4th palpal segment twice the length of the 3d. Taken on red clover.... p r a t e n s i s n. sp., C. 141

ff 17 antennal segments, the 5th having the basal enlargement ½ longer than its diameter; the 3d and 4th palpal segments equal; bred from small clustered rosette bud galls on willow............r a c e m i n. sp., C. 1245

ee Subcosta uniting with the margin at the basal 3d

f 5th antennal segment having the basal enlargement with a length ½ greater than its diameter

g 15 antennal segments; the ventral plate slender, deeply emarginate, the lobes short; harpes subacute .... acerifolia Felt, C. 36

gg 16 antennal segments; ventral plate stout, deeply emarginate, the lobes long; harpes truncate; bred from large terminal rosette bud gall on rose.......... rosacea n. sp., C. 1244

ff 5th antennal segment having the basal enlargement with a length twice its diameter

g 15 antennal segments; harpes obliquely truncate with conspicuous quadrate teeth; bred from a subglobular polythalamous gall on side of willow twig globosa n. sp., a1084a

gg 17 antennal segments; harpes subacute with variable quadrate teeth; bred from a Triticoides and Hordeoides gall of Walsh .... triticoides Walsh, a1076, a1087

ccc 5th antennal segment with a stem as long as the basal enlargement

d 16 antennal segments, the 5th having the basal enlargement with a length ¼ greater than its diameter; the 4th palpal segment ¼ longer than the 3d; bred from a Strobiloides gall..? albovittata Walsh, a1442b

cccc 5th antennal segment with a stem ¼ longer than the basal enlargement

d 16 antennal segments; the dorsal plate triangularly incised; ventral plate deeply and narrowly incised; bred from a deformed willow bud .... gemmae n. sp., C. 254

aaa 18 to 20 antennal segments

b Females, antennal segments sessile

c 18 antennal segments

d Antennal segments tapering distally

e Length 2.5 mm; abdomen dark brown; the 5th antennal segment with a length ½ greater than its diameter; thinly setulose; the 4th palpal segment ½ longer than the 3d; bred from whitish cocoons on poplar..... populi Felt, C. 78x, a322, a1126

ee Length 3 mm; abdomen dark brown; the 5th antennal segment with a length twice its diameter; thickly setulose; 4th palpal segment ¼ longer than the 3d; bred from a small, oval, rosette gall on willow....... normaniana n. sp., C. 1246

ccc Length 1.5 mm; abdomen reddish brown; the 5th antennal segment with a length twice its diameter; thickly setulose; the 4th palpal segment ¼ longer than the 3d; bred from twigs on Cephalanthus........c e p h a l a n t h i n. sp., C. 1048

cc 19 or 20 antennal segments

d Abdomen dark brown; the 5th antennal segment with a length ½ greater than its diameter; the 3d and 4th palpal segments equal; bred from a gouty twig gall on willow........b a t a t a s Walsh, a686, a1102, a1108

dd Abdomen reddish brown; the 5th antennal segment with a length twice its diameter; the 4th palpal segment ¼ longer than the 3d; bred from a fleshy pouch gall on Spiraea leaf ......s a l i c i f o l i a Felt, C. 1045, a1505

bb Males, antennal segments stemmed

c Stem of the 5th antennal segment ⅓ the length of the basal enlargement

d 19 antennal segments; length 3 mm; dorsal plate very deeply incised, almost divided; the harpes truncate . . c o n s o b r i n a Felt, C. 39

dd 18 antennal segments; length 2mm; dorsal plate very deeply emarginate; harpes subtriangular; bred from whitish cocoon on poplar.......................... p o p u l i Felt, C. 78x, a322, a1126

cc Stem of the 5th antennal segment ½ the length of the basal enlargement

d Length 2.5 mm; harpes rounded distally............. a b s o b r i n a Felt, C. 40

ccc Stem of the 5th antennal segment with a length ¾ that of the basal enlargement

d Length 2.5 mm; ventral plate long, narrowly and deeply incised; bred from gouty gall on willow twig...... b a t a t a s Walsh, a686, a1102, a1108

cccc Stem of the 5th antennal segment as long as the basal enlargement

d Length 1.5 mm; ventral plate long and broadly rounded distally; bred from pouch fold gall on Spiraea leaf.. s a l i c i f o l i a Felt, a1505

aaaa 21 or more antennal segments

b Females, segments sessile or subsessile

c Length 4 mm; 22 to 23 antennal segments, the 5th with a length twice its diameter; abdomen dark reddish brown; bred from inconspicuous swellings on willow twigs...... p o d a g r a e n. sp., a1399, a1076y

cc Length 5 mm; 26–29 antennal segments. Bred from clustered rosette gall on dwarf willow.......................... r h o d o i d e s Walsh, C. 1247, 775–77

ccc 25 to 26 antennal segments; lateral whitish tufts on abdomen usually well marked; lobes of ovipositor oval with a length twice their breadth; bred from pine cone gall on willow.. s t r o b i l o i d e s Walsh

cccc 24 antennal segments; the lateral tufts on abdomen not well marked; lobes of ovipositor long, narrowly oval, with a length 2½ times the width; bred from rosette gall on willow ....b r a s s i c o i d e s Walsh

bb Males, antennal segments stemmed

c Stem of the 5th antennal segment with a length ¾ of the basal enlargement, males

d 23 antennal segments; the 4th palpal segment ½ longer than the 3d; apical processses on harpes short, broadly rounded; length 4 mm; lateral tufts on abdomen well marked; bred from pine cone gall on willow........ s t r o b i l o i d e s Walsh, a1173, a1340, a1442, C. 1248

dd 22 antennal segments; 4th palpal segment as long as the 3d; the apical chitinous processes on the harpes, long, subquadrate; length 3.5 mm; lateral tufts on abdomen not well marked; bred from loose leaf rosette gall on willow.. b r a s s i c o i d e s Walsh, a1433, a1467

ddd 23 to 25 antennal segments; harpes broadly truncate; length 4 mm; bred from large loose apical leaf gall on willow ......? r h o d o i d e s Walsh, C. 775-77, 1247

dddd 21 to 23 antennal segments; length 3 mm; bred from slightly swollen willow twigs........................ p o d a g r a e n. sp., a1399, a1076y

OLIGOTROPHIARIAE

This group is composed mostly of rather large species which may be recognized by the third vein being well separated from the anterior margin, the rather short cylindric antennal segments, and the simple claws.

HOST PLANTS AND GALLS OF THE OLIGOTROPHIARIAE

The following tabulation of the known galls produced by members of this group will undoubtedly prove of service in identifying the various species.

Antennaria

Oval bud gall on A. p l a n t a g i n i f o l i a.........................
R h o p a l o m y i a a n t e n n a r i a e, C. 960

Woolly apical galls presumably on Antennaria ....
R h o p a d o m y i a p i l o s a, C. 1215

Artemisia

Globular woolly galls about 1 cm in diameter.........................
R h o p a l o m y i a a l t i c o l a, C. 768

Aster

Dwarf flower heads on *A. paniculata* .... *Rhopalomyia asteriflorae* C. a1757
Axillary bud galls on *A. lateriflorus* .... *Rhopalomyia lateriflori*, C. a1731
Oval twig gall on *A. novae-angliae* .... *Rhopalomyia astericaulis*, C. 1107a

Audibertia stachyoides

Gall undescribed ....*Rhopalomyia audibertiae*, C. 1029

Baccharis pilularis

Flower gall... ...*Rhopalomyia californica*, C. 1003, 983, 984
Stem gall.....................*Rhopalomyia baccharis*, C. 982

Betula (birch)

Bred from seeds................*Oligotrophus betulae* Winn.

Bigelovia

Hollow, stem gall..........*Rhopalomyia bigeloviae*, C. 1070
Oval seed gall..........*Rhopalomyia bigelovioides*, C. 940

Celtis (hackberry)

Leaves ....*Mayetiola celtiphyllia*, C. 913, 918

Comptonia (sweetfern)

Fleshy leaf fold............*Janetiella asplenifolia*, C. 1103

Gutierrezia sarothrae

Oval swelling in flower heads.. *Rhopalomyia gutierreziae*, C. a1742

Hordeum (barley)

Leaf sheaths ....*Mayetiola destructor*, C. 771, 772

Juniperinus californica (juniper)

Galled fruit ....*Walshomyia juniperina*, C. 1049

Ribes (currant)

Mayetiola californica, C. 919

Salix (willow)

Apical rosette gall...................*Mayetiola walshii*, C. 774
Apical beak gall....................*Mayetiola rigidae*, C. a687
Slender twigs..................*Mayetiola caulicola*, C. a1822a
Subglobose galls on slender twigs *Mayetiola tumidosae*, C. 1300
Stems ....*Mayetiola perocculta*, C. 1251
Mayetiola americana, C. 920

Solidago (goldenrod)

Flower galls

On S. canadense

Subglobular, smooth, budlike, 2 mm in diameter ....
Rhopalomyia racemicola, C. a1605

Cylindric, pubescent, 6 mm long ....
Rhopalomyia anthophiia, C. 1039, a1608

On Solidago, gall undescribed ....
Rhopalomyia cruziana, C. 942

Leaf galls

Apical rosette galls

On S. canadense....Rhopalomyia carolina, C. a1635
Rhopalomyia albipennis, C. a1655
Oligotrophus inquilinus, C. a1665

On S. canadense and S. serotina.......................
Rhopalomyia capitata, C. a1750, a1754
Rhopalomyia inquisitor, C. a1750a

Subapical or lateral oval gall on Euthamia lanceolata ....
Rhopalomyia lanceolata, C. 784

On leaves

Euthamia lanceolata

Ribbed, fusiform, 6 mm long ....
Rhopalomyia fusiformis, C. a1150

Fusiform stemmed gall 13 to 14 mm long ....
Rhopalomyia pedicellata, C. a1650

Solidago rugosa

Very small, fusiform, 1.6 mm long ....
Rhopalomyia clarkei, C. a1634

Stem galls

Euthamia lanceolata

Ribbed, fusiform, 6 mm....Rhopalomyia fusiformis, C. a1150

Fusiform stemmed gall, 13 to 14 mm...............................
Rhopalomyia pedicellata, C. a1650

Subglobular, near tip, 1.5 cm in diameter ....
Rhopalomyia lobata, C. a1647

Solidago

Large, suboval, near ground.......................................
Rhopalomyia hirtipes, C. 1059, a1284

Bulbletlike at base of stem.. Rhopalomyia bulbula, C. 1115

Stout, cylindric, on root stock ....
Rhopalomyia thompsoni, C. 1100

Triticum (wheat)

Leaf sheaths................Mayetiola destructor, C. 771, 772

Ulmus (elm)

Buds and young, curled leaves....Mayetiola ulmi, C. 1239, a1683

Viola (violet)

Rolled leaves......Mayetiola (Diplosis) violicola, C. a1346

Vitis (grape)

Tumid leaf (vitis) gall.........Janetiella brevicauda, C. 878

Key to genera

a Palpi uni or biarticulate
- *b* Ovipositor of female short, enlarged, triangular; terminal clasp segment of male distinctly prolonged, not fusiform...Walshomyia n. g.
- *bb* Ovipositor of female short with the sickle-shaped plate projecting dorsally..Sackenomyia n. g.
- *bbb* Ovipositor of female fleshy, at least moderately long, not enlarged, terminal lobes rather short and stout; terminal clasp segment of male short, stout, fusiform....................Rhopalomyia Rubs.

aa Palpi triarticulate..................................Oligotrophus Latr.

aaa Palpi quadriarticulate
- *b* 3d vein uniting with costa at the apex of the wing...Mayetiola Kieff.
- *bb* 3d vein uniting with costa well before the apex of the wing........ Janetiella Kieff.

WALSHOMYIA n. g.

This genus appears to be intermediate between Rhopalomyia and Rhabdophaga. It has 18 or 19 antennal segments, those of the male distinctly stalked, with but one palpal segment and simple

Fig. 33 Walshomyia juniperina, male and female antennal segments, much enlarged. (Origin

claws. It is separated from the former by the terminal clasp segment of the male being distinctly prolonged, not swollen and strongly fusiform as in Rhopalomyia. The structure of the dorsal plate, ventral plate and genitalia approach that of Rhabdophaga. The pulvilli are remarkably long, being nearly twice the length of the claws. The female has the terminal segment distinctly enlarged to form a subtriangular apical process [fig. 35] instead of the much prolonged ovipositor of Rhopalomyia. Type Walshomyia juniperina n. sp.

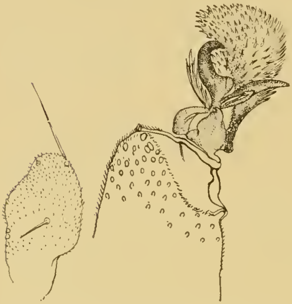


Fig. 34 Walshomyia juniperina, palp and claw, much enlarged. (Original)

Fig. 35 Walshomyia juniperina, dorsal view of ovipositor, much enlarged. (Original)

It is a pleasure to dedicate this genus to the late Benjamin Dann Walsh, who did such thorough work upon the species of Cecidomyiidae infesting the willow.

Walshomyia juniperina n. sp.

Male. Length 1.5 mm; antennae probably extending to the fourth abdominal segment, thickly haired, light reddish brown, composed of 18 segments. Mesonotum light reddish brown. Scutellum reddish yellow, postscutellum a little darker. Abdomen dark reddish brown, the genitalia greatly enlarged, reddish yellow. Wings hyaline. Halteres yellowish basally, slightly fuscous apically. Legs somewhat variable fuscous yellowish.

Female. Length 2 mm. Antennae extending to the third abdominal segment, rather thickly haired, light reddish brown,

composed of 16 or 17 segments. Mesonotum dark reddish brown with submedian lines indistinct, yellowish. Scutellum reddish yellow, postscutellum reddish brown. Abdomen shiny, rather dark reddish brown. Other colorational features practically as in the opposite sex.

Bred June 19, 1884, from fruit of Juniperus californica taken at New Indria, Cal. Type C. 1049.

Fig. 36 Sackenomyia acerifolia, fifth antennal segment and palp, much enlarged. (Original)

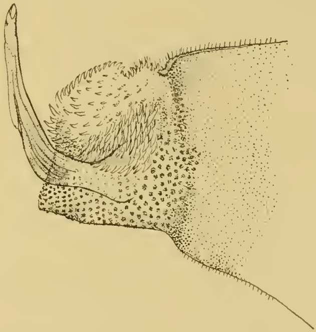


Fig. 37 Sackenomyia acerifolia, lateral view of ovipositor, much enlarged. (Original)

SACKENOMYIA n. g.

The antennae are composed of twelve segments; the palpi are triarticulate, and the claws are simple. This genus is easily distinguished by the short ovipositor with the sickle-shaped blade [fig. 37] projecting dorsally from the posterior extremity. Type Oligotrophus acerifolius Felt. The wing is shown on plate 36, figure 2.

RHOPALOMYIA Rubs.

This genus was erected in 1892 by Rubsaamen, with R. tanaceticola Karsch as type. This species is a very characteristic form, the third vein uniting with the margin at the apex of the wing; the fifth with its distal portion very faint, joins the posterior margin at the distal third, its branch near the basal third. The pulvilli are fully as long as the simple claws, the palpi uniarticulate and the antennae composed of 19 segments in both sexes. The fifth segment in the male has a stem equal to the basal enlargement, which latter has a length about twice its diameter, a thick subbasal whorl of rather long, stout setae and the distal two thirds ornamented with a thick whorl of long, curved setae; low circumfili presumably occur on the enlargement near the basal third and apically. The genitalia are of the same type commonly seen in American representatives of this genus. The fifth segment of the female antennae has a stem ½ the length of the basal enlargement, which latter is produced and has a length nearly 2½ times its diameter and with the distal two thirds irregularly traversed by rather numerous anastomosing circumfili. The ovipositor is probably about ½ the length of the abdomen when fully extended, the terminal lobes rather short, broad and tapering to a broadly rounded apex, rather sparsely clothed with coarse setae.

The American representatives of this genus have a very close general resemblance, being usually reddish brown, rather large insects. They vary widely in certain characteristics, the male antennae ranging in number from 23 segments down to 12 segments, and the stem of the fifth segment varying in length from about ¼ longer than the basal enlargement to a stem only ⅓ the length of the basal enlargement. The segments of the female antennae vary in number from 25 to 13 and may have a stem ⅓ the length of the basal enlargement or be practically sessile. The palpi are uni or biarticulate. The male genitalia and the ovipositor of the female are quite characteristic of the genus, though approached in form by certain other genera. The general appearance of the wing is characteristic, the third vein uniting with the margin at or very close to the apex, while the distal third of the fifth vein is very faint [pl. 34, fig. 2, 10]. The claws are invariably simple and the pulvilli usually as long or a little longer than the claws.

Members of this genus display a marked preference for flower or bud galls, a very large proportion being reared from deformed buds, among which may be classed the conspicuous apical rosette galls, the less conspicuous flower or bud galls and the reduced flower heads. A number also breed in leaf galls such, for example, as R. pedicellata and R. fusiformis, both of which inhabit a very characteristic type of gall appearing on the stem, the leaf or even in the flower head. Certain species breed in bud galls near the base of the stem as, for example, R. bulbula, and one species, R. thompsoni, in the root stock. The well known R. hirtipes is unique among our eastern forms, in that it produces a very characteristic gall on the stem. This latter exception, however, is more apparent than real, since the original point of attack is undoubtedly on the young growing stem, and it might be considered as an injury just falling short of the terminal bud. The last named species is easily separated from allied forms. American members of this genus display a marked preference for Solidago, some fourteen species having been reared therefrom, while the closely allied Aster supports three additional forms. Each of the species of this genus producing a gall on Solidago, makes a characteristic deformity which appears to be correlated with well marked structural differences in the adult, and presumably by divergencies in habits.

Key to species

a Antennae with 20 or more segments

b 24 to 25 antennal segments; abdomen dark reddish brown; palpi biarticulate; female, bred from loose, rosette galls on Solidago canadensis......................carolina n. sp., C. a1635

bb 22 to 23 antennal segments

c Abdomen dark brown; legs dark brown; antennal stem ¼ longer than the basal enlargement; palpi biarticulate; male major Felt, C. 90

cc Abdomen reddish brown or brownish red; antennal stem in male ¾ and in female ⅓ the length of the basal enlargement; male and female, bred from subglobular stem gall on Solidago .... (Cecidomyia) hirtipes O. S., C. a1059, a1284

bbb 20 to 21 antennal segments

c Antennal stem ¼ longer than the basal enlargement; abdomen fuscous yellowish; legs fuscuous yellowish

d Palpi biarticulate, the basal enlargement with a length twice its diameter; male, bred from terminal rosette gall on Solidago ....capitata n. sp., C. a1750

dd Palpi uniarticulate, basal enlargement with a length ½ greater than its diameter; male, bred from terminal rosette gall on Solidago .... inquisitor n. sp., C. a1750a

cc Antennal stem as long as the basal enlargement

d Abdomen yellowish red; mesonotum reddish brown; wings narrow; antennae with 18 to 20 segments; male, bred from subglobular budlike gall on Solidago...... (Cecidomyia racemicola O. S.).............. racemicola n. sp., C. a1605

dd Abdomen dark fuscous yellowish; mesonotum brown; wings broad; ventral plate deeply emarginate; male.. apicata n. sp., C. 529

ddd Abdomen dark brown; mesonotum dark brown; wings broad, ventral plate slightly emarginate; male, bred from subcylindric, pubescent bud gall on Solidago..... (Cecidomyia) anthophila O. S., C. 1039, a1608

ccc Antennal stem ¾ the length of the basal enlargement

d Wings with whitish cast; abdomen fuscous yellowish; mesonotum dark brown; palpi biarticulate; male, bred from terminal rosette gall on Solidago.............. albipennis n. sp., C. a1655

dd Wings hyaline; abdomen dark fuscous; mesonotum light brown; palpi uniarticulate; male, bred from fusiform leaf gall on Euthamia......................... fusiformis Felt, C. a1150

cccc Antennal segments sessile; abdomen fuscous reddish brown; mesonotum yellowish brown; palpi biarticulate; female, bred from terminal rosette gall on Solidago..................... capitata n. sp., C. a1750, a1754

d Abdomen reddish orange; mesonotum yellowish brown; palpi uniarticulate; female, bred from axillary bud gall on Aster...........lateriflori n. sp., C. a1731

aa Antennae with 18 or 19 segments

b Antennal stem as long as the basal enlargement

c Abdomen reddish brown

d Palpi uniarticulate; male, bred from gall on Baccharis.. californica n. sp., C. 1003, 983, 984

dd Palpi biarticulate; male, bred from stem gall on Baccharis ....baccharis n. sp., C. 982

cc Abdomen fuscous yellowish; mesonotum reddish brown; palpi uniarticulate; male, bred from axillary bud gall on Aster.. lateriflori n. sp., C. a1731

ccc Abdomen yellowish red; mesonotum reddish brown; palpi biarticulate; male, bred from subglobular, budlike gall on Solidago..................racemicola n. sp., C. a1605

bb Antennal stem ¾ the length of the basal enlargement

c Palpi biarticulate

d Abdomen brownish red; mesonotum dark red; male, bred from ovoid, fleshy, root stock gall on Solidago........ thompsoni Felt, C. 1100

cc Palpi uniarticulate

d Antennae with 19 segments

e Abdomen dark brown; mesonotum reddish brown; male..................abnormis n. sp., C. 580

ee Abdomen dark fuscous; mesonotum light brown; male, bred from fusiform leaf gall on Euthamia... fusiformis Felt, C. a1150

dd Antennae with 18 segments

e Abdomen reddish brown; mesonotum reddish brown

f Basal enlargement of antennal segments with a length ½ greater than its diameter; lobes of dorsal plate truncate apically; male........... truncata n. sp., C. 1050

ff Basal enlargement of antennal segments with a length twice its diameter; lobes of dorsal plate rounded distally; male, bred from oval twig gall on Aster..astericaulis Felt, C. 1107a

ee Abdomen dark reddish brown; mesonotum reddish brown; male, bred from fruit of Juniperus....... Walshomyia juniperina n. sp., C. 1049

eee Abdomen fuscous yellowish

f Mesonotum dark brown; bred from bulblike galls on Solidago.........bulbula n. sp., C. 1115

ff Mesonotum shining red; male, bred from axillary bud gall on Aster........................... lateriflori n. sp., C. a1731

eeee Abdomen yellowish brown; mesonotum reddish brown; male..................pini Felt, C. 116

bbb Antennal stem with a length ⅓ the basal enlargement

c Abdomen fuscous yellowish; mesonotum fuscous yellowish; male, bred from stemmed, fusiform gall on Euthamia leaves or stems............pedicellata n. sp., C. a1650, a1311

cc Abdomen dark reddish brown; mesonotum dark brown; female.....................palustris n. sp., C. 1208

bbbb Antennal segments sessile or nearly so

c Palpi biarticulate

d Antennal segments 19

e Abdomen and mesonotum reddish; female, bred from subcylindric, pubescent bud gall on Solidago...... anthophila O. S., C. 1039, a1608

ee Abdomen reddish brown; mesonotum dark reddish brown; female, bred from stem gall on Baccharis baccharis n. sp., C. 982

dd 18 antennal segments

e Abdomen dark carmine; mesonotum bright yellowish; scutellum pale yellow; female, bred from subglobular, budlike gall on Solidago....................
racemicola n. sp., C. a1605

ee Abdomen and mesonotum dark brown or black; scutellum dark reddish brown; female, bred from ovoid, fleshy, root stock gall on Solidago.........
thompsoni Felt, C. 1100

cc Palpi uniarticulate

d Antennae with 19 segments

e Abdomen dark red; mesonotum reddish brown; legs fuscous yellowish; female, bred from stemmed, fusiform gall on Euthamia leaves or stems........
pedicellata n. sp., C. a1650, a1311, 686

ee Abdomen dark brown; mesonotum reddish brown; legs dark brown; female, bred from subglobular stem gall on Euthamia...lobata n. sp., C. a1647

eee Abdomen dark brown; mesonotum dark brown; tibiae and tarsi fuscous; female, bred from dwarf flower heads of Aster ....
asteriflorae Felt, C. a1757

eeee Abdomen fuscous yellowish; mesonotum yellowish brown; legs fuscous yellowish; female, bred from terminal rosette gall on Solidago ....
inquisitor n. sp., C. a1750a

dd Antennae with 18 segments

e Abdomen reddish brown; mesonotum brown; legs dark brown; female, bred from fusiform leaf gall on Euthamia....fusiformis Felt, C. 843, a1150

ee Abdomen pale yellowish; mesonotum dark brown; legs fuscous yellowish; female, bred from bulblike galls on Solidago........bulbula n. sp., C. 1115

eee Abdomen light brown; mesonotum dark brown; legs light brown; female, bred from gall on Bigelovia..
bigelovioides n. sp., C. 940

eeee Abdomen reddish brown; mesonotum dark reddish brown; legs light brown; female, bred from gall on Baccharis..californica n. sp., C. 1003, 983, 984

aaa Antennae with 17 segments or less

b Antennae with 17 segments

c Antennal stem as long as the basal enlargement

d Abdomen fuscous yellowish; mesonotum fuscous yellowish; male, bred from woolly apical bud gall on ?Antennaria.........................pilosa n. sp., C. 1215

dd Abdomen light brown; mesonotum shining brown; male, bred from flower galls on Solidago................
cruziana n. sp., C. 942

cc Antennal stem ¾ the length of the basal enlargement

d Abdomen light yellowish; mesonotum light brown; male, bred from apical rosette gall on Euthamia............
lanceolata n. sp., C. 784

ccc Antennal stem 1/3 the length of the basal enlargement

d Abdomen light brown; mesonotum dark brown; female, bred from gall on Bigelovia ....
bigelovioides n. sp., C. 940

dd Abdomen fuscous yellowish; mesonotum dark brown; female, bred from woolly apical bud gall on ?Antennaria......................pilosa n. sp., C. 1215

cccc Antennal segments sessile or nearly so

d Abdomen and mesonotum reddish brown; scutellum reddish yellow; female, bred from fruit of Juniperus.....
Walshomyia juniperina n. sp., C. 1049

dd Abdomen dull red; mesonotum and scutellum dark red; female, bred from very small, fusiform gall on Solidago leaves......................clarkei Felt, C. a1634

bb Antennae with 16 segments

c Antennal stem with a length 3/4 that of the basal enlargement

d Abdomen dark reddish brown; mesonotum dark brown; male, bred from woolly bud gall on Antennaria........
(Cecidomyia) antennariae Whlr., C. 960

cc Antennal stems 1/3 the length of the basal enlargement

d Abdomen yellowish brown; mesonotum dark brown; male, bred from woolly, globular gall on branches of Artemisia..(Cecidomyia) alticola Ckll., C. 768

dd Abdomen dark reddish brown; mesonotum brownish black; female, bred from woolly, globular gall on branches of Artemisia..............................
(Cecidomyia) alticola Ckll., C. 768, a1353

ccc Antennal segments sessile or nearly so

d Abdomen dark reddish brown; mesonotum dark brown; female, bred from woolly bud gall on Antennaria......
(Cecidomyia) antennariae Whlr., C. 960

bbb Antennae with 15 segments

c Antennal stem 1/4 longer than the basal enlargement

d Abdomen yellowish brown; legs dark brown; on Solidago; male.................arcuata Felt, C. 124

cc Antennal stems with a length 3/4 that of the basal enlargement

d Abdomen and mesonotum brown; palpi uniarticulate; male, bred from suboval flower or bud galls on Gutierrezia ....
(Asphondylia) gutierreziae Ckll., C. a1742

ccc Antennal segments sessile or nearly so

d Palpi biarticulate

e Abdomen light brown; mesonotum shining brown; female, bred from flower galls on Solidago........
cruziana n. sp., C. 942

dd Palpi uniarticulate

e Abdomen yellowish; mesonotum reddish brown; female, bred from apical rosette gall on Euthamia lanceolata n. sp., C. 784

ee Abdomen reddish or light yellowish brown; mesonotum reddish brown; female, bred from a hollow gall on Bigelovia....bigeloviae Ckll., C. 1070

bbbb Antennae with 13 to 14 segments

c Abdomen brownish red; mesonotum reddish brown; female, bred from suboval flower or bud galls on Gutierrezia....... (Asphondylia) gutierreziae Ckll., C. a1742

cc Abdomen and mesonotum dark brown; female, bred from gall on Audibertia................audibertiae Felt, C. 1029

bbbbb Antennae with 12 segments

c Antennal stem with a length ¾ that of the basal enlargement

d Abdomen and mesonotum dark brown; palpi uniarticulate; male, bred from gall on Audibertia............... audibertiae Felt, C. 1029

cc Antennal segments sessile or nearly so

d Abdomen pale yellowish; palpi biarticulate .... (Oligotrophus) Sackenomyia acerifolia Felt, C. 38

OLIGOTROPHUS Latr.

This group, as at present restricted, comprises a number of forms related to Dasyneura and Rhabdophaga and differing therefrom by having the claws simple. It is separated from more closely allied genera by the triarticulate palpi. The wing is illustrated on plate 36, figure 1.

Key to species

a 13 or 14 antennal segments; abdomen dark brown

b 13 or 14 sessile antennal segments, the 5th with the basal enlargement ¼ greater than its diameter, the 3d palpal segment twice the length of the 2d; female, bred from Betula seeds........................ betulae Winn., C. 964

bb 14 subsessile antennal segments, the 5th with a stem about ¼ the length of the basal enlargement, which latter has a length twice its diameter; the 3d palpal segment is 3 times the length of the 2d; female..................................vernalis n. sp., C. 60

aa 15 antennal segments

b Abdomen dark brown, the 5th antennal segment with a stem ⅓ the length of the basal enlargement; male, bred from Betula seeds...... betulae Winn., C. 964

aaa 16 antennal segments

b Abdomen fuscous yellowish, the 5th antennal segment with a stem ¼ longer than the basal enlargement; bred from an apical rosette gall on Solidago.................. ..inquilinus n. sp., C. a1655a

MAYETIOLA Kieff.

This genus is of particular interest, as it includes the exceedingly injurious wheat pest known as the Hessian fly, M. destructor Say. It comprises an assemblage of species which may be recognized by the third vein uniting with costa at or beyond the apex, in connection with the quadriarticulate palpi and simple claws. Plate 36, figure 6 illustrates a unique form, possibly the representative of another genus.

Key to species

a 12 to 15 antennal segments
- *b* 12 antennal segments
  - *c* Abdomen yellowish; antennae light brown, the segments subsessile; male......(Oligotrophus) azaleae Felt, C. 48
- *bb* 13 sessile or subsessile antennal segments
  - *c* Abdomen and antennae dark brown; male..................... (Oligotrophus) aceris Felt, C. 66a
  - *cc* Abdomen reddish brown; ovipositor ¼ the length of the body; female........................... virginiana n. sp., C. 80
  - *ccc* Abdomen reddish brown; ovipositor as long as the body; female balsamifera n. sp., C. 146
- *bbb* 14 antennal segments
  - *c* Posterior tarsi normal
    - *d* Antennal segments sessile
      - *e* Abdomen reddish brown, the 5th antennal segment with a length twice its diameter, the 4th palpal segment ½ longer than the 3d; ovipositor 1/5 the length of the abdomen ....electra n. sp., C. 507
      - *ee* Abdomen bright red, the 5th antennal segment with a length 2½ times its diameter, the 4th palpal segment a little longer than the 3d; ovipositor as long as the body, female; bred from elm buds and folded leaves.... ulmi Beutm., C. 1239, a1683
    - *dd* Antennal segments subsessile, with a stem ¼ or ⅓ the length of the basal enlargement
      - *e* 3d vein uniting with costa well beyond the apex
        - *f* Abdomen pale yellowish, the 5th antennal segment with a stem ¼ the length of the basal enlargement; male... (Oligotrophus) thalictri Felt, C. 98
      - *ee* 3d vein uniting with costa just beyond the apex
        - *f* Abdomen brownish red; ovipositor short; female.... socialis n. sp., C. 97
        - *ff* Abdomen yellowish or fuscous yellowish; ventral plate of the male deeply and roundly emarginate distally; the female with the ovipositor as long as the body; bred from rolled violet leaves........... (Diplosis) violicola Coq., C. a1346

cc 2d to 4th segments of the posterior tarsi greatly enlarged; abdomen pale yellowish, greenish dorsally; 3d vein uniting with costa just beyond the apex; antennae dark brown, the 5th segment with a stem ½ the length of the basal enlargement; male
l a t i p e s n. sp., C. 511

bbbb 15 antennal segments

c Abdomen dark reddish; antennae dark reddish brown, the 5th segment with a stem ¼ the length of the basal enlargement; male
(O l i g o t r o p h u s) t s u g a e Felt, C. 165

aa 16 to 19 antennal segments

b 16 antennal segments

c Antennal segments sessile, the 5th with a length 2½ times its diameter; ovipositor ½ the length of the abdomen

d Abdomen reddish brown, the body slender, the lobes of the ovipositor with a length twice their width; bred from slender willow twigs; female..........................
c a u l i c o l a n. sp., C. a1822a

dd Abdomen dark brown, the body stout, the lobes of the ovipositor with a length 3½ times their width; bred from subglobose galls on slender willow twigs....................
t u m i d o s a e n. sp., C. 1300

cc Antennal segments with more or less of a stem

d The 5th antennal segment with a stem ¼ the length of the basal enlargement, which latter has a length twice its diameter; abdomen yellowish brown; 3d and 4th palpal segments equal; bred from R i b e s; female..............
c a l i f o r n i c a n. sp., C. 919

dd 5th antennal segment with a stem ⅓ the length of the basal enlargement; abdomen dark brown; bred from slender willow twigs; male............c a u l i c o l a n. sp., C. a1822a

ddd 5th antennal segment with a stem ½ the length of the basal enlargement; abdomen yellowish brown; bred from R i b e s; male..............c a l i f o r n i c a n. sp., C. 919

dddd 5th antennal segment with a stem ¼ longer than the basal enlargement; abdomen fuscous; bred from elm buds and folded leaves................u l m i Beutm., C. 1239, a1683

bb 17 antennal segments

c 5th antennal segment with a stem ¾ the length of the basal enlargement; abdomen dark brown; bred from willow; male.....
a m e r i c a n a n. sp., C. 920

bbb 18 antennal segments

c 5th antennal segment with a stem ¾ the length of the basal enlargement

d Abdomen reddish brown; bred from wheat stems; male.....
(C e c i d o m y i a) d e s t r u c t o r Say, C. 771, 772

bbbb 19 antennal segments

c Abdomen reddish brown; 5th antennal segment with a length 3 times its diameter; ovipositor ¼ the length of the abdomen, the lobe with a length twice its width; bred from wheat stems; female........(C e c i d o m y i a) d e s t r u c t o r Say, C. 771

cc Abdomen dark brown; 5th antennal segment with a length ½ greater than its diameter; ovipositor ½ the length of the abdomen, the lobe with a length 3 times its width; bred from willow; female.................. americana n. sp., C. 920

aaa 20 or more antennal segments

b Antennal segments sessile

c Abdomen reddish; 24 to 26 antennal segments, the 5th with a length ½ greater than its diameter; the ovipositor ¼ the length of the abdomen, the lobe with a length ½ greater than its width; bred from apical beak gall on willow; female........ (Cecidomyia, Rhabdophaga) rigidae......... O. S., C. a687

cc Abdomen light brown; 26 antennal segments, the 5th with a length 2½ times its diameter; the ovipositor ⅓ the length of the abdomen, the lobes with a length only ¾ the width; bred from a small clustered rosette willow gall; female............. walshii n. sp., C. 774, ?924, a1813

ccc Abdomen reddish brown; 24 antennal segments, the 5th with a length 2½ times its diameter; the ovipositor as long as the body, the lobe with a length 4 times its width; bred from Celtis leaves; female.......celtiphyllia n. sp., C. 913, 918

bb Antennal segments with a distinct stem

c 5th antennal segment with a stem ½ the length of the basal enlargement

d Abdomen reddish brown; 24 antennal segments; bred from a beak gall on willow; male................................ (Cecidomyia) rigidae O. S., C. a687

cc 5th antennal segment with a length ¾ the basal enlargement

d Abdomen dark brown; 20 antennal segments; bred from Salix stems; male....................................... (Cecidomyia) perocculta Ckll., C. 1251

dd Abdomen pale yellowish; 25 to 26 antennal segments; bred from a small clustered rosette willow gall; male............... walshii n. sp., C. 774

ccc 5th antennal segment with a stem as long as the basal enlargement

d Abdomen reddish brown; 22 to 23 antennal segments; bred from Celtis leaves; male................................. celtiphyllia n. sp., C. 913, 918

JANETIELLA Kieff.

This genus comprises a number of forms which may be separated from Oligotrophus Latr. by the quadriarticulate palps and may be distinguished from Mayetiola Kieff. by the third vein uniting with costa well before the apex of the wing [pl. 36, fig. 4].

Key to species

a 12 antennal segments

b Abdomen light brown, the dorsal plate triangularly emarginate; male (Oligotrophus) tiliacea Felt, C. 83

bb Abdomen fuscous yellowish, the dorsal plate deeply and broadly emarginate; male ....
(Oligotrophus) brevicornis Felt, C. 281

bbb Abdomen red, the ovipositor rather short; female..................
sanguinea n. sp., C. 17

aa 14 antennal segments

b Abdomen reddish brown, the 5th antennal segment with a stem ⅓ the length of the basal enlargment; male ....
(Oligotrophus) nodosa Felt, C. 10

bb Abdomen fuscous yellowish, the 5th antennal segment with a stem ¾ the length of the basal enlargement; male...................
americana n. sp., C. 616

aaa 15 antennal segments

b Abdomen deep orange and yellowish, the 5th antennal segment of the male with a stem ¾ the length of the basal enlargement; female with the ovipositor ⅔ the length of the abdomen; bred from a fleshy leaf fold on Comptonia ....
(Oligotrophus) asplenifolia Felt, C. 1103

bb Abdomen dark brown basally, reddish apically, the 5th antennal segment with a stem ½ the length of the basal enlargement......
(Oligotrophus) acerifolia Felt, C. 35

bbb Abdomen reddish brown; ovipositor short; bred from Lasioptera vitis gall.........................brevicauda n. sp., C. 878

aaaa 16 antennal segments

b Abdomen yellowish red, the 5th antennal segment with a stem ¼ longer than the basal enlargment; male..........................
(Oligotrophus) pini Felt, C. 87

bb Abdomen dark brown; antennal segments sessile, ovate, the 5th with a length twice its diameter, the ovipositor ¼ the length of the abdomen ....breviaria n. sp., C. 77

ASPHONDYLIARIAE

This group comprises mostly large, heavy-bodied insects, easily recognized by the long, cylindric, sessile antennal segments and the simple claws. The species breed for the most part in buds of various plants.

TABLE OF ASPHONDYLID GALLS

Amsinckia

Galls on A. lycopsoides......Schizomyia macrofila, C. 855

Antennaria (everlasting)

Apical bud gall................Asphondylia antennariae, C. 870

Artemisia

Galls taken at Fort Grant, Ariz..................A. artemisiae, C. 861

Aster

Aborted head of A. patens..........................A. monacha

Atriplex

Irregular, oblong gall on A. canescens......A. atriplicis, C. 945

Azalea

Green bud gall..................................A. azaleae, C. a1481

Bumelia

Galls on B. lanuginosa.....................A. bumeliae, C. 849

Carya (hickory)

Conical leaf gall..................Cincticornia caryae, C. 1114
Long conic leaf gall..................Schiz. caryaecola, C. a1786a

Ceanothus

Apical bud gall on C. velutinus ....A. ceanothi, C. 872

Diervilla (bush honeysuckle)

Green bud gall on D. trifida..............A. diervillae, C. a1469

Helenium

Apical rosette gall on H. autumnale......A. autumnalis, C. 1238

Helianthus (sunflower)

Flower heads appearently unmodified on H. strumosus............
A. helianthiflorae, C. a1718
Subglobular enlarged flower head..............A. conspicua, C. a1697
Large stem gall...............................A. globosus, C. 856

Hydrangea

Bud gall on H. arborescens............A. hydrangeae, C. 852

Ilicoides

Green bud gall on I. mucronata..........A. ilicoides, C. a1548

Larrea

Gall on L. tridentata.........................A. auripila, C. 851

Opuntia or Cactus

Swollen fruit......................................A. betheli, C. a1776
Large swollen fruit..........................A. arizonensis, C. 857
Gall undescribed.................................A. opuntiae, C. 848

Quercus (oak)

Reddish, oval, hard leaf gall......C. pilulae, C. 1105, 811, 814, 850, 1046
Flat leaf gall on Q. rubra...............C. quercifolia, C. 1043
Blister swelling on lateral leaf veins...........C. americana, C. a1792
Circular blister gall on scarlet oak leaves...........C. serrata, C. a1791

Rhus (sumac)

Deformed flower bud on R. integrifolia........................... A. integrifoliae, C. 868

Rivina

Bud gall on R. humilis...................Schiz. rivinae, C. 943

Salix (willow)

Twig gall....................................A. salictaria, C. 859

? Sambucus (elder)

Hoary subglobular bud gall.....................A. sambuci, C. a1511

Sicca

On ripe fruit......................................A. siccae, C. 1213

Solidago (goldenrod)

Florets apparently unmodified on Euthamia lanceolata.......... A. monacha, C. a1200 etc.
Small rosette or large bud gall on Euthamia lanceolata.......... A. monacha
Adherent leaf gall on S. canadensis and S. serotina......... A. monacha
Bred from undetected gall.....................A. johnsoni, C. 809

Vagnera (wild spikenard)

Deformed berries of V. racemosa..........A. smilacinae, C. 860

Vernonia

Galls on V. noveboracensis...........A. vernoniae, C. 867

Viburnum

Probably bud or blossom gall...............Schiz. viburni, C. 1212

Vitis (grape)

Woolly massed bud gall...............Schiz. coryloides, C. 874
Hard, nutlike, polythalamous gall..........Schiz. pomum, C. a14346
Oval or fusiform petiole or tendril gall..Schiz. petiolicola, C. a17S4

Unknown shrub

Irregular subglobular bud gall.....................A. florida, C. 873

Key to the genera

a Palpi with 1 to 3 segments, the terminal clasp segments of the male bidentate..Asphondylia H. Lw.

aa Palpi with 4 segments

b Antennae with 14 segments; male with the terminal clasp segment unidentate; the basal clasp segment lobed distally; female with the apical portion of the ovipositor aciculate....Schizomyia Kieff.

bb Antennae with 13 or 14 segments; male with the terminal clasp segment flattened and denticulate apically; female with the ovipositor short, broad at base and tapering to the subacute apex..... Cincticornia n. g.

ASPHONDYLIA H. Lw.

Antennae with 14 cylindric, sessile segments, those of the male only slightly reduced distally, with rather numerous low strongly convolute circumfili. Palpi with one to three segments. The terminal clasp segment of the male genitalia short, stout, swollen near the middle, and apically with a heavy bidentate chitinous process. The female antennae are greatly reduced distally, the 12th much shorter than the normal, the 13th with a

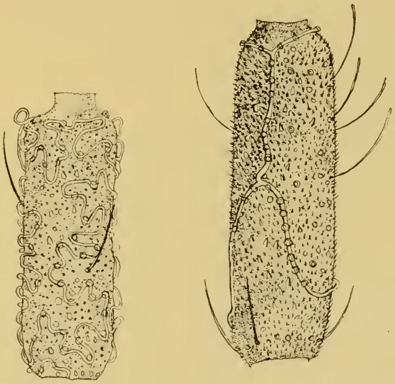


Fig. 38 Asphondylia monacha O. S., 6th antennal segment of male and female, much enlarged. (Original)

length scarcely greater than its diameter and the 14th subglobose or even reduced to a small disk, the circumfili consisting of a low band near the basal third or fourth, the branches produced on one side and fused to form a longitudinal filum which unites with a low apical circumfilum. Ovipositor with a distinct taper-

ing, fleshy part and a long, slender, aciculate portion. Basally there is a characteristic dorsal pouch consisting of two broadly rounded, thickly haired lobes separated mesially by a broadly rounded emargination.

Key to species

a Palpi 1 segmented
- *b* Length 1.5 mm; abdomen dark reddish brown; scutellum yellowish red..................................brevicauda Felt, C. 1040
- *bb* Length 2.5 to 3 mm; abdomen with long, yellowish hairs; bred from gall on Larrea tridentata........................ auripila n. sp., C. 851

aa Palpi 2 segmented
- *b* Small, 3 to 4 mm long
  - *c* Abdomen dark brown or black
    - *d* Tibiae dark brown; bred from brownish, fusiform Azalea buds ....azaleae Felt, C. a1481
      - *e* Tarsi dark brown, the posterior yellowish; bred from apparently unmodified flower heads of Helianthus strumosus....helianthiflorae n. sp., C. a1718
    - *dd* Tibiae yellowish brown
      - *e* Tarsi dark brown; bred from swollen Opuntia fruit... betheli Ckll., C. a1776
      - *ee* Tarsi yellowish.............fulvopedalis Felt, C. 546
  - *cc* Abdomen reddish brown; bred from unripe fruits of Sicca disticha.........................siccae n. sp., C. 1213

aaa Palpi 3 segmented
- *b* Small, 1.5 to 2.5 mm long
  - *c* Abdomen light or reddish brown
    - *d* Scutellum pale yellowish; bred from galls on Bumelia lanuginosa.................bumeliae Felt, C. 849
    - *dd* Scutellum reddish brown
      - *e* Basal abdominal segments yellowish; bred from bud gall on unknown shrub........florida n. sp., C. 873
      - *ee* Abdomen unicolorous; bred from flower buds of Rhus integrifolia......integrifoliae n. sp., C. 868
- *bb* Medium sized, 3 to 4 mm long
  - *c* Tarsi plainly white-banded; bred from apical rosette gall on Euthamia lanceolata, from apparently unmodified florets of the same, and from oval galls between adherent leaves of Solidago serotina or S. canadensis monacha O. S.,[1] C. 761, 807, 812, 813, a1200, a1195, a1336, a1568a and y
  - *cc* Tarsi unicolorous or nearly so
    - *d* Abdomen yellowish brown
      - *e* Scutellum pale yellowish; tibiae and tarsi yellowish brown; bred from deformed berries of Vagnera racemosa..............smilacinae Felt, C. 860

[1] A. solidaginis Beutm. and A. patens Beutm. are synonyms of this species. A. recondita O. S. is undoubtedly the same form.

ee Scutellum fuscous yellowish, basal segments of posterior tarsi yellowish; bred from subglobose stem galls on Helianthus.......g l o b o s u s O. S., C. 854, 856, 869

eee Scutellum fuscous orange, legs light brown; bred from galls on unknown plant in Arizona.................... b a r o n i n. sp., C. 865

eeee Scutellum yellowish brown

f Legs yellowish brown; bred from galls on Artemisia.. a r t e m i s i a e n. sp., C. 861

eeeee Scutellum dark brown

ff Legs dark brown; bred from woolly apical bud galls on Antennaria .... (A s y n a p t a) a n t e n n a r i a e Whlr., C. 870

dd Abdomen reddish brown

e Scutellum fuscous orange; bred from galls on V e r n o n i a n o v e b o r a c e n s i s...................... v e r n o n i a e n. sp., C. 863, 867

ee Scutellum dark reddish brown; bred from loose terminal bud galls on Ceanothus......c e a n o t h i n. sp., C. 872

ddd Abdomen dark brown

e Scutellum yellowish brown

f 3d antennal segment with a length 6 times its diameter, posterior tarsi dark brown; bred from bud galls on Hydrangea.........h y d r a n g e a e Felt, C. 852

ff 3d antennal segment with a length 4 times its diameter, posterior tarsi with the basal segments yellowish; bred from bud gall on Helenium........ a u t u m n a l i s Beutm., C. 1238, 853

ee Scutellum dark brown; abdomen white-haired; bred from twig gall on Atriplex....a t r i p l i c i s Ckll., C. 864, 945

eee Scutellum dark reddish; legs black; bred from subcortical stem gall on Sambucus....................... s a m b u c i n. sp., C. a1511

eeee Scutellum slaty gray; legs dark brown; bred from Diervilla buds...........d i e r v i l l a e Felt, C. a1469

eeeee Scutellum pruinose; tibiae black; bred from bud galls on Ilicoides...............i l i c o i d e s Felt, C. a1548

dddd Abdomen brown; scutellum yellowish brown; legs dark brown; bred from Salix twigs..s a l i c t a r i a Felt, C. 859

ddddd Abdomen reddish brown; legs fuscous yellowish; bred from Solidago......................j o h n s o n i n. sp., C. 809

bbb Large species, 5 to 6 mm long

c Abdomen dark brown or dark reddish brown

d Scutellum reddish brown; bred from galls on Opuntia .... o p u n t i a e n. sp., C. 848, 858, 862

cc Abdomen brown; scutellum yellowish; bred from subglobular enlarged flower head of Helianthus.......................... c o n s p i c u a O. S., C. 544, 806, 808, 810, 854, ?856, 866, a1679, a1697

ccc Abdomen yellowish brown; scutellum fuscous yellowish; legs yellowish brown; bred from fruitlike enlargement of prickly pear
a r i z o n e n s i s Felt, C. 857

SCHIZOMYIA Kieff.

Antennae consisting of 14 cylindric, sessile or subsessile segments, those of the male slightly shortened distally and each with remarkably stout, elevated, strongly convolute circumfili. Palpi with four segments. The basal clasp segment of the male genitalia projects well beyond the insertion of the terminal clasp segment, which latter bears apically a more or less distinct chitinous tooth. Female with the segments distally greatly shortened as in Asphondylia, the circumfili nearly the same as in Asphondylia. Ovipositor with a distinct fleshy basal portion, tapering distally and bearing the characteristic aciculate organ of Asphondylia; the dorsal basal pouch absent, the ventral sclerite of the seventh segment more or less strongly chitinized and somewhat characteristic of this genus.

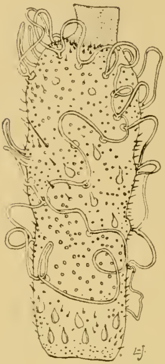


Fig. 39 S c h i z o m y i a a l t i f i l a Felt, 6th antennal segment of male, much enlarged. (Original)

Fig. 40 S c h i z o m y i a r u b i Felt, side view of abdomen, showing the long oviposito and characteristic ventral plate, enlarged. (Original)

Key to species

a Abdomen dark brown
b Wings rather large, narrow
c Scutellum reddish, 5th antennal segment with a length four times its diameter, the 4th palpal segment ½ longer than the 3d, female; taken on viburnum blossoms..v i b u r n i n. sp., C. 1212
cc Scutellum fuscous yellowish, 5th antennal segment with a length six times its diameter, the 4th palpal segment twice the length of the 3d, female; bred from long, conic leaf gall on hickory..
c a r y a e c o l a n. sp., C. a1786a
aa Abdomen reddish brown
b Wings small, narrow; on blueberry..............................
(A s p h o n d y l i a) a l t i f i l a Felt, C. 177

bb Wings small, broad; swept from blackberry .... (Asphondylia) rubi Felt, C. 685
bbb Wings large, rather broad; bred from Amsinckia galls.............. (Asphondylia) macrofila Felt, C. 855, 1001
aaa Abdomen yellowish or light brown
b Wings large, tarsi unicolorous or nearly so
c 5th antennal segment with a length six times its diameter, the 4th palpal segment with a length ¼ greater than the 3d, female; bred from apical leaf bud gall on grape .... coryloides Walsh & Riley, C. 874
cc 5th antennal segment with a length five times its diameter, 4th palpal segment with a length ¾ greater than the 3d, male; bred from hard, nutlike, polythalamous gall on grape........ pomum Walsh & Riley, a1434b
bb Wings small, broad yellow banded
c Posterior tarsi rather broadly yellow banded; 5th antennal segment with a length six times its diameter, the 4th palpal segment ¼ longer than the 3d, female; bred from bud galls on Rivina humilis ....rivinae n. sp., C. 943
cc Posterior tarsi black; 5th antennal segment with a length four and five times the diameter, the 4th palpal segment 1½ and 1¾ the length of the 3d in the male and female respectively; bred from oval or fusiform tendril or petiole galls on Vitis bicolor.. petiolicola n. sp., C. a1784

CINCTICORNIA n. g.

Antennae consisting of 13 or 14 segments, only slightly shortened distally and in some species there is more or less fusion between the 13th and 14th; circumfili in the male transverse, usually numerous, distinct and anastomosing, ranging in numbers from 6 to 15 to each segment. Palpi with four segments. Genitalia with the terminal clasp segment short, stout, the distal margin flattened, heavily chitinized and finely dentate. Female with the antennae very similar to those of the male, except that there are three to five or six transverse, anastomosing circumfili, the latter forming a more or less irregular network on the face of the segment; a scattering subbasal whorl of short, stout setae and a few stout setae near the distal third may occur in some species. Ovipositor stout, broad at the base and tapering to a subacute apex bearing a pair of indistinct terminal lobes, and

Fig. 44 Cincticornia transversa Felt, 6th antennal segment of male, much enlarged. (Original)

with the ventral portion of the ovipositor more or less chitinized. The characteristic aciculate organ of Asphondylia and Schizomyia is wanting.

Certain species of this genus agree with Kieffer's published diagnosis of Polystepha. Asphondylia transversa Felt is the tpye. Specimens of C. multifila Felt were submitted to this well known European authority who pronounced it a representative of a new genus, consequently the above name is proposed.

Key to species

a Abdomen dark brown
  b Wings small, rather broad
    c Scutellum reddish brown; antennal segments with 10 to 12 circumfili; male, habits unknown .... (Asphondylia) transversa Felt, C. 53
    cc Scutellum dark reddish, 5th antennal segment with 4 coarsely reticulate circumfili, length 2 mm, female; bred from slight blister swelling on lateral veins of red oak leaves .... americana n. sp., a1792
    ccc Scutellum fuscous yellowish; antennal segments with 9 to 10 circumfili; male, bred from warty, reddish brown leaf gall on oak leaf (Cecidomyia) .... pilulae Walsh, C. 811, 814, 850, 1046, 1105
  bb Wings small, broad; scutellum reddish brown; antennal segments with 6 to 7 circumfili; male, habits unknown .... (Asphondylia) multifila Felt, C. 95, 99, 100
  bbb Wings small, narrow, abdomen dark brown, 5th antennal segment with 8 circumfili, length 2 mm, male; bred from circular, blister gall on scarlet oak leaves..................serrata n. sp., a1791
  bbbb Wings rather large, somewhat broad; scutellum purplish brown; 3d antennal segment with a length 2½ times its diameter; female, habits unknown....................canadensis n. sp., C. 1042
aa Abdomen reddish brown
  b Wings small, narrow
    c Scutellum yellowish; antennae with 13 segments, each with 10 circumfili; male, bred from conical gall on hickory leaf........ caryae n. sp., C. 1114
  bb Wings large, rather broad
    c Scutellum yellowish; antennal segments with 10 to 15 circumfili; male, bred from a flat, relatively inconspicuous gall on Quercus rubra leaves............quercifolia n. sp., C. 1043
    cc Scutellum yellowish brown; 3d antennal segments with a length twice its diameter; female, bred from a flat, relatively inconspicuous gall on Quercus rubra leaves................. quercifolia n. sp., C. 1043
    ccc Scutellum reddish yellow; antennal segments with 3 to 4 circumfili; male....(Asphondylia) sobrina Felt, C. 1108

aaa Abdomen dull red; wings small, narrow; scutellum reddish yellow; 3d antennal segment with a length 2½ times its diameter; female, bred from warty, reddish brown leaf gall on oak leaf........................
(Cecidomyia) pilulae Walsh, C. 811, 814, 850, 1046, 1105

aaaa Abdomen yellowish

b Abdomen yellowish brown; wings small, broad; antennal segments with 6 to 7 circumfili; male, swept from sumac ....
(Oligotrophus) rhoina Felt, C. 94

bb Abdomen pale yellow, wings rather small, medium width, 5th antennal segment with 7 circumfili, finely reticulate, length 2.5 mm, male; bred from slight blister swelling on lateral veins of red oak leaves.........................americana n. sp., a1792

bbb Abdomen pale orange; wings large, narrow; scutellum pale yellowish; 3d antennal segment with a length 3½ times its diameter; female ....(Asphondylia) sobrina Felt, C. 1108

bbbb Abdomen reddish yellow; wings large, broad; scutellum fuscous yellowish; 3d antennal segment with a length 2½ times its diameter; female ....connecta n. sp., C. 822

DIPLOSARIAE

The members of this tribe are easily distinguished by the long, slender, thickly haired, 14 segmented antennae, the flagellate segment being binodose and usually provided with two or three circumfili. The palpi vary from uniarticulate in a European form, to quadriarticulate. The third vein may unite with the margin well before the apex, as in Arthrocnodax, or at or well beyond, as in some other species. The claws are simple or toothed. This group presents some exceedingly interesting variations, not only in antennal but also in genitalic structures, the latter presenting extreme diversity. Owing to time limitations it has not been possible up to the present to prepare keys for the separation of the females.

The members of this group appear to live largely in the more tender, leafy or bud tissues, though a considerable number are inquilines, while a few live upon fungus or are zoophagous.

HOSTS, HOST PLANTS AND GALLS OF THE DIPLOSARIAE

Agrimonia (agrimony)

Bred from florets ....Contarinia agrimoniae, C. a1696

Amelanchier (shadbush)

Bred from truncate leaf gall....Hormomyia canadensis, C. a1758

Apis (bee)

Bred from hive debris ....Arthrocnodax apiphila, C. a1775

Apocynum (dogbane)

Bred from flowers......Lestodiplosis apocyniflorae, C. a1684
" " ....Cecidomyia apocyni, C. a1684a

Asclepias (milkweed)

Bred from rolled leaf ....Lestodiplosis asclepiae, C. a1588

Aspidiotus (A. uvae)

Bred from insect ....Dentifibula cocci, C. 1018

Avena (oat)

Reared from cage with aphid infested seedlings; probably predaceous......
Coquillettomyia texana, C. a1728

Carya (hickory)

Bred from melon-shaped leaf gall..Hormomyia thompsoni, C. 1116a
" globular leaf gall............Hormomyia caryae, C. 1104y
" smooth, subglobular leaf gall......Hormomyia arcuaria, C. 1104z
" hairy, subglobular leaf gall......Hormomyia holotricha, C. 1111
" hairy, globose leaf gall......Mycodiplosis holotricha, C. 1104a
" globose leaf gall.........Clinodiplosis caryae, C. 1117
" tubular leaf gall..........Hormomyia tubicola, C. 1106

Catalpa

Bred from dwarfed shoots ....Cecidomyia catalpae, C. a1804

Cattleya gigas

Bred from roots ....Clinodiplosis cattleyae, C. 979

Clematis (virgin's bower)

Bred from irregular, subglobular gall.......Contarinia clematidis, C. a1659b
" flowers ....Lestodiplosis clematiflorae, C. a1694b

Corylus (hazel)

Bred from hairy leaf fold...Mycodiplosis corylifolia, C. a1543b

Crataegus (thorn)

Bred from thorn leaf...............Lestodiplosis florida, C. 986
" cockcomb leaf gall...Hormomyia crataegifolia, a1362
" cylindric fimbriate leaf gall.......................................
Lestodiplosis crataegifolia, C. a1555

Eupatorium ageratoides (white snake root)

Bred from pustulate leaf and stem galls.....................................
Lestodiplosis eupatorii, C. a1280

Eupatorium perfoliatum (boneset)

Bred from florets ....Contarinia perfoliata, C. a1689

Fraxinus (ash)

Bred from rolled leaves....Lestodiplosis fraxinifolia, C. a1572

Gossypium (cotton)

Bred ....Contarinia gossypii, C. 1331

Liriodendron (tulip)

Bred from purplish blister gall on leaf......Contarinia liriodendri

Melo (melon)

Bred from curled melon tips ....Contarinia setigera
" probably from aphids or Cecidomyiids on curled tips..................
Aphidoletes cucumeris

Mentha (mint)

Bred from pustulate gall...........Giardomyia menthae, C. a1578b

Negundo (box elder)

Bred from leaves ....Contarinia negundifolia, C. 967

Oecidium impatientis

Bred from this fungus.......Mycodiplosis impatientis, C. a1542

Phylloxera vastatrix

Bred from Phylloxera galls.....Lestodiplosis grassator, C. 962

Pinus (pine)

Bred from resin masses ....Cecidomyia resinicola, C. a185

Platanus (plane tree)

Bred from leaves ....Lestodiplosis platanifolia, C. a1669a

Populus (poplar)

Bred from subglobular leaf gall....Dichrodiplosis populi, C. a1743
" subglobular leaf gall........Mycodiplosis populifolia, C. a1514
" rolled edge of leaf........Lestodiplosis populifolia, C. a1490
" subglobular leaf gall..Lestodiplosis globosus, C. a1656

Prunus cerasus (cherry)

Bred from deformed fruit........Contarinia virginianiae, C. 769
" fusiform twig gall......Lestodiplosis cerasi, C. a1593a
" folded, thickened leaves.....Mycodiplosis cerasifolia, C. a1571

Pyrus (pear)

Bred from deformed fruit............Contarinia pyrivora, C. 790

Quercus (oak)

Bred from folded leaf edge..........Cecidomyia foliora, C. 1339
Probably bred from oak leaves..Dichrodiplosis quercina, C. 1006
Bred from ? leaf..................Contarinia quercifolia, C. 1015

Rhus (sumac)

Bred from heads of curled leaves..Arthrocnodax rhoina, C. a1720b

Rumex (dock)

Bred from deformed seeds ....Contarinia rumicis, C. a1595

Sambucus (elder)

Bred from rolled leaves...Arthrocnodax sambucifolia, C. a1723

Scrophularia (figwort)

Bred from distorted flower buds....................................
Lestodiplosis scrophulariae, C. a1569

Siphonophora liriodendri

Predaceous on aphid.........Aphidoletes meridionalis, C. 1005

Solidago (goldenrod)

Bred from elongate, brown leaf spot.................................
Lestodiplosis solidaginis, C. a1655
Bred........................Lestodiplosis triangularis, C. 763

Sorghum

Bred from seeds...................Contarinia sorghicola, C. 972

Spiraea (meadowsweet)

Bred from terminal bud gall........Hormomyia clarkei, C. a1759a
" flowers.......Cecidomyia spiraeaflorae, C. a1681b
" unopened flowers......Prodiplosis floricola, C. a1681

Tanacetum (tansy)

Bred probably from aphids..........Aphidoletes basalis, C. a1722

Taxodium (cypress)

Bred from fusiform twig gall.........Contarinia ananassi, C. 926

Tecomia (trumpet vine)

Bred from curled leaves............Cecidomyia tecomiae, C. 1260

Tetranychus (red spider)

From red spider on citrus trees...Mycodiplosis acarivora, C. 847

Triticum (wheat)

Bred from wheat heads........................Cecidomyia tritici

Verbena

Bred from rolled leaves...........Cecidomyia urtifolia, C. a1577
" " .....Lestodiplosis verbenifolia, C. a1577a

Yucca angustifolia

Bred from pods...................Lestodiplosis yuccae, C. 1017

Key to genera

a Mesonotum usually greatly produced over the head; 14-26 segments; usually heavy species ....Hormomyia H. Lw.
aa Mesonotum not greatly produced over the head; only 14 segments; usually slender species
b Male with the two nodes of the antennal segments nearly equal, only two circumfili to a segment; claws simple
c Basal clasp segment with a conspicuous triangular process apically ....Dentifibula n. g.
(Type Cecidomyia viburni Felt)
cc Basal clasp segment with no process apically
d Wings with the posterior area greatly produced, broadly rounded [pl. 38, fig. 3, 4]...........................Lobopteromyia n. g.
(Type C. filicis Felt)
dd Wings normal, usually with a length twice the width [pl. 37, fig. 6]
Contarinia Rond.
bb Male with the two nodes of the antennal segments subequal, three circumfili, usually well developed, to each segment
c Claws toothed
d All claws toothed ....Dichrodiplosis Kieff.
dd Anterior claws toothed, posterior simple
e Circumfili very uneven, the ventral loops greatly produced
f The middle circumfili rudimentary, apparently but two circumfili ....Bremia Rond.
ff Three well developed circumfili.............Aphidoletes Kieff.
ee Circumfili even or nearly so
f Basal clasp segment lobed
g Lobe apical, the terminal clasp segment subapical ....
Lobodiplosis n. g.
(Type Mycodiplosis acerina Felt)
gg Lobe basal, setose.....................Coquillettomyia n. g.
(Type Mycodiplosis lobata Felt)
ff Basal clasp segment not distinctly lobed
g Terminal clasp segment subfusiform, greatly dilated ....
Karshomyia n. g.
(Type Mycodiplosis viburni Felt)

gg Terminal clasp segment slender, distinctly longer than the basal clasp segment .... Youngomyia n. g.
(Type Dichrodiplosis podophyllae Felt)
ggg Terminal clasp segment normal, not as above............... Mycodiplosis Rubs.
cc Claws simple
d Distal flagellate antennal segments cylindric, stemmed, not binodose Prodiplosis n. g.
(Type Cecidomyia floricola Felt)
dd All flagellate segments binodose at least
e Third vein uniting with costa well before the apex.............. Arthrocnodax Rubs.
ee Third vein uniting with costa at or beyond the apex of the wing
f Palpi triarticulate
g Ventral plate or harpes conical, serrate..Odontodiplosis n. g.
(Type Cecidomyia karnerensis Felt)
gg Ventral plate not serrate; basal clasp segment stout......... Adiplosis n. g.
(Type Cecidomyia toxicodendri Felt)
ff Palpi quadriarticulate
g Claws bent at right angles or nearly so
h Ventral plate deeply and roundly emarginate, the dorsal plate dilated, the lateral angles being strongly produced.. Hyperdiplosis n. g.
(Type Cecidomyia lobata Felt)
hh Ventral plate very long, slender, roundly emarginate, the dorsal plate not greatly dilated......... Giardomyia n. g.
(Type Cecidomyia photophila Felt)
gg Claws not bent at right angles
h Basal clasp segment conspicuously lobed or spined
i Basal clasp segment with one or more heavy, chitinous spines apically...................... Metadiplosis n. g.
(Type M. spinosa n. sp.)
ii Basal clasp segment with a long, setose process apically Epidiplosis n. g.
(Type E. sayi n. sp.)
iii Basal clasp segment with a triangular lobe basally; ventral plate scarcely longer than broad..Lestodiplosis Kieff.
hh Basal clasp segment without conspicuous lobes or spines
i Dorsal and ventral plates short, broad, triangularly emarginate; terminal clasp segment short, stout, the apex broad, serrate.................. Paradiplosis n. g.
(Type Cecidomyia obesa Felt)
ii Not as above
j Dorsal plate divided, the lobes greatly produced and broadly rounded laterally......... Obolodiplosis n. g.
(Type Cecidomyia orbiculata Felt)
jj Not as above
k Ventral plate long, linear, narrowly rounded apically Clinodiplosis Kieff.
kk Ventral plate not as above........ Cecidomyia Meig.

HORMOMYIA H. Lw.

The species included in this genus at the present time represent two rather distinct types. The more typical form is large and heavy-bodied, with the mesonotum greatly produced over the head. The wings are long, narrow, and the males of this division have 14-26 binodose antennal segments, the circumfili being short, the loops rarely having a length greater than the distance separating the stems. Another type provisionally referred to this genus, is most easily recognized by the short wings, broadly rounded posteriorly and having a width about ¾ the length. These species are rather small and the males have the short, stout circumfili characteristic of the larger forms. American representatives of these smaller forms, so far as known, breed exclusively in hickory leaf galls.

Fig. 42 Hormomyia americana Felt, 12th antennal segment of male, much enlarged. (Original)

Key to species

a Wings long, usually with a length more than twice the width [pl. 37, fig. 2]
- *b* Antennae composed of more than 20 segments
  - *c* Palpi uniarticulate
    - *d* Antennae with 25 segments; abdomen yellowish, male....... americana Felt, C. 91
  - *cc* Palpi biarticulate
    - *d* Antennae with 27 segments; abdomen yellowish, with the 5th, 6th and 7th segments dull orange; ventral plate long, broad, broadly rounded distally, male..palustris Felt, C. 1205
    - *dd* Antennae with 26 segments; abdomen uniformly fuscous yellowish; ventral plate long, broad, deeply and triangularly emarginate, male...............needhami Felt, C. 788
- *bb* Antennae with less than 20 segments
  - *c* Antennae composed of 18 segments
    - *d* Abdomen dark brown, the 3d and 4th segments margined posteriorly with yellow; palpi biarticulate, female.......... atlantica n. sp., C. 815
  - *cc* Antennae composed of 15 segments
    - *d* Abdomen dark brown, the 8th segment mostly yellowish; palpi biarticulate; ventral plate long, spatulate, truncate apically, male..............consobrina n. sp., C. 1204
  - *ccc* Antennae composed of 14 segments

d Palpi biarticulate

e Abdomen dark reddish brown; the 2d palpal segment not 3 times the length of the 1st; ventral plate long, broad, roundly and slightly emarginate, male; bred from truncate gall on Amelanchier .... canadensis n. sp., a1758

ee Abdomen dark reddish; the 2d palpal segment 3 times the length of the 1st, female; bred from a terminal bud gall on Spiraea..........clarkei n. sp., a1759a

dd Palpi triarticulate

e Abdomen shiny black; ventral plate spatulate, truncate dorsally, male................johnsoni Felt, C. 821

ee Abdomen dark red; ventral plate short, broad, broadly emarginate, male; bred from cockscomb gall on Crataegus leaves..........crataegifolia Felt, a1362

aa Wings broad, broadly rounded posteriorly, the width about ⅔ the length [pl. 37, fig. 5]. Palpi tri or quadriarticulate

b Palpi triarticulate

c Abdomen dark salmon or deep red; 5th antennal segment with a broad, smooth area and slightly constricted near the basal 3d; 3 circumfili, the loops heavy, rather short, broad; ventral plate roundly emarginate, male; bred from tubular gall on oak leaves (Cecidomyia) tubicola O. S., C. 1106, a1450

cc Abdomen light yellowish; 5th antennal segment cylindric, tapering at both extremities, with 3 circumfili, the loops heavy, rather short, broad, male; bred from melon-shaped, with depressed center, hickory leaf gall..thompsoni n. sp., C. 1116a

bb palpi quadriarticulate

c Abdomen fuscous or deep carmine; 5th antennal segment having the basal stem with a length ¾ its diameter, the distal stem with a length ½ its diameter, the basal enlargement slightly produced, with a length twice its diameter and tapering at both extremities; circumfili indistinct, short, the loops with a length about equal to the distance separating their insertions; dorsal plate broadly and roundly emarginate.................. (Cecidomyia) caryae O. S., C. 1104y

cc Abdomen orange or deep carmine; 5th antennal segment with the basal portion of the stem hardly apparent, the distal part very short, the basal enlargement subcylindric, with a length about ½ its diameter, the distal enlargement cylindric, with a length ½ greater than its diameter; circumfili heavy, the loops thick, the basal loops reaching to the insertion of the 2d circumfilum, the loops of the distal circumfilum to the base of the following segment; dorsal plate nearly truncate, very slightly and broadly emarginate; bred from smooth subglobular, nippled gall on hickory ....arcuaria n. sp., C. 1104z

ccc Abdomen pale yellowish; 5th antennal segment having the basal portion of the stem with a length equal to its diameter, the distal part with a length ¾ its diameter, the distal enlargement oval with a length ½ greater than its diameter; circumfili very faint, probably 3; dorsal plate deeply and narrowly emarginate; bred from a subglobular, densely haired hickory leaf gall....(C e c i d o m y i a) h o l o t r i c h a O. S., C. 1111

DENTIFIBULA n. g.

This group comprises a number of forms easily separated from the more typical species referred to Contarinia, by the conspicuous, triangular apical process on the basal clasp segment, the terminal clasp segment is therefore subapical. All of the species are small pale yellowish forms. The wing is represented on plate 38, figure 1.

Key to species

a Distal portion of the stem of the 5th antennal segment rather short, with a length about 4 times its diameter; the 5th tarsal segment on the anterior legs longer than the 4th

b Entire insect yellowish with the exception of a dark spot on the dorsal part of the abdomen; wing hairs curved; antennal setae rather fine, circumfili long. Taken on hickory..c a r y a e Felt, 332b

bb Mesonotum yellowish brown, the remainder of the insect light yellowish; wing hairs nearly straight; antennal setae coarse; circumfili rather short. Bred from A s p i d i o t u s u v a e..........
c o c c i n. sp., C. 1018

aa Distal portion of antennal stem of the 5th segment long, with a length about 5 times the diameter; 5th tarsal segment of anterior legs as long as the 4th

b Entire insect a pale yellowish orange. Taken on V i b u r n u m......
v i b u r n i Felt, C. 210, 591

LOBOPTEROMYIA n. g.

This genus comprises a number of very distinct forms easily separable from Contarinia, to which they are closely related, by the broad wings. These organs have a conspicuous, broadly rounded extension posteriorly, making the width about ⅔ the length [pl. 38, fig. 3, 4]. The antennae are also peculiar in that the basal portion of the stem on the flagellate segments rarely has a length equal to its diameter. The enlargements are relatively large, subglobose, and the circumfili rather short, stout and uniform.

Key to species

a Abdomen yellowish

b Basal portion of the stem of the 5th antennal segment with a length about ½ its diameter

c Mesonotum yellowish and slaty brown; the distal portion of the stem of the 5th antennal segment with a length 2½ times its diameter, slightly expanded apically; the basal clasp segment stout, tapering slightly. Taken on fern .... filicis Felt, C. 20, ?23

cc Mesonotum sooty yellow; the distal portion of the stem of the 5th antennal segment with a length ½ greater than its diameter, slightly expanded apically; basal clasp segment stout, broadly rounded apically. Taken on basswood, Tilia.................. apicalis n. sp., C. 52

ccc Mesonotum dark brown; the distal portion of the stem of the 5th antennal segment with a length twice its diameter, greatly expanded distally; the basal clasp segment short, broad, tapering strongly. Taken on skunk cabbage, Symplocarpus............. foetedi n. sp., C. 24, 28

bb The basal portion of the stem of the 5th antennal segment with a length ½ greater than its diameter

c Mesonotum reddish brown; the distal portion of the stem of the 5th antennal segment with a length 3 times its diameter; the basal clasp segment short, stout and tapering strongly. Taken on skunk cabbage, Symplocarpus...................... symplocarpi n. sp., C. 23

aa Abdomen yellowish red

b Mesonotum dark brown; the basal portion of the stem of the 5th antennal segment with a length only ½ its diameter; the basal clasp segment short, stout and roundly tapering distally. Taken on fern...............................consobrina Felt, C. 61

aaa Abdomen light brown; the basal portion of the stem of the 5th antennal segment with a length ½ its diameter

b Mesonotum dark brown; basal clasp segment very short, stout and roundly tapering apically. Taken on basswood..tiliae Felt, C. 25

bb Mesonotum light brown; the basal clasp segment very short and stout. Taken on sedge....................caricis n. sp., C. 19

aaaa Abdomen reddish brown

b Mesonotum yellowish brown; the basal portion of the stem of the 5th antennal segment with a length ½ its diameter; the basal clasp segment short, stout and narrowly rounded apically. Swept from pine abdominalis n. sp., C. 16

CONTARINIA Rond.

This genus, as at present limited, may be recognized by the nearly equal nodes of the male antennae each with but one circumfilum. The wings are rather long and narrow, the length usually being twice that of the width [pl. 37, fig. 6]. The claws are simple and the basal clasp segment of the male lacking the conspicuous subtriangular apical process so characteristic of Dentifibula.

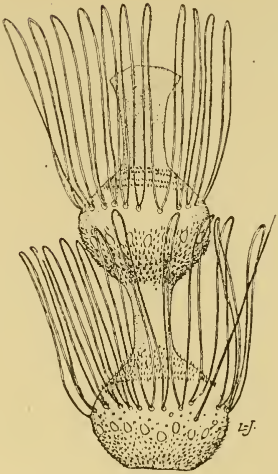


Fig. 43 Contarinia pyrivora Riley, 5th antennal segment of male, much enlarged. (Original)

Key to species

a Small yellowish species with very few or no fuscous markings

b The 5th antennal segment having the basal portion of the stem with a length twice its diameter

c Mesonotum yellowish brown, the dorsal plate with lobes broad, broadly rounded and sparsely setose apically.................... trifolii Felt, C. 108

cc Mesonotum reddish brown, dorsal plate with lobes long, narrowly rounded and thickly setose apically. Bred from Eupatorium perfoliatum......perfoliata n. sp., a1689

bb The 5th antennal segment with the basal portion of the stem with a length at least 3 times its diameter

c Mesonotum and abdomen pale yellowish, the distal segments of the latter variably clouded with fuscous; antennae ½ longer than the body; the 5th antennal segment having the basal part of the stem with a length 3 times its diameter; terminal clasp segment short, irregularly expanded and convolute, the apex strongly recurved..................erratica n. sp., C. 1021

cc Mesonotum dark brown; wings long, narrow; antennae twice the length of the body; the 5th antennal segment with a length 4 times its diameter; setae and circumfili slightly produced ventrally. Bred from oak.........quercifolia n. sp., C. 1015

aa Species usually larger and with more color

b Abdomen yellowish or yellowish red

c Mesonotum sooty yellow

d Abdomen fuscous yellowish, sparsely haired, the 5th antennal segment having the basal part of the stem with a length twice its diameter, the distal portion with a length 4 times its diameter; the 4th palpal segment ½ longer than the 3d
f l a v o l i n e a n. sp., C. 231

cc Mesonotum reddish brown

d Abdomen yellowish brown, the 5th antennal segment having the basal portion of the stem ½ longer than its diameter, the distal part a little over twice its diameter; the 4th palpal segment a little longer than the 3d. Bred from deformed cherry ....v i r g i n i a n i a e Felt, C. 769

ccc Mesonotum dark brown

d Abdomen fuscous greenish white or yellowish

e 5th antennal segment with the basal portion of the stem with a length equal to its diameter, the distal part with a length 2½ times its diameter; the 4th palpal segment a little longer than the 3d. Bred from Agrimonia.....
a g r i m o n i a e Felt, a1696

ee 5th antennal segment with the basal portion of the stem with a length 2½ times its diameter, the distal part with a length 4 times its diameter; the 4th palpal segment with a length ¼ greater than the 3d. Bred from cotton ....g o s s y p i i Felt, C. 1331

dd Abdomen pale yellowish, the segments narrowly margined posteriorly with fuscous yellow; the 2 parts of the stem of the 5th antennal segment with a length ½ greater than the diameter; the 4th palpal segment more than twice the length of the 3d. Bred from Rumex.....................
r u m i c i s H. Lw., a1595

ddd Abdomen fuscous yellowish; the 5th antennal segment with the basal portion of the stem with a length ½ greater than its diameter, the distal part with a length 2½ times its diameter; the 4th palpal segment ½ longer than the 3d....
d i v a r i c a t a n. sp., C. 350

dddd Abdomen pale salmon, the 5th antennal segment with the basal portion of the stem with a length twice its diameter, the distal portion with a length 2½ times its diameter; the 4th palpal segment twice the length of the 3d. Taken on Sambucus ....s a m b u c i f o l i a Felt, C. 153

ddddd Abdomen greenish yellow; the 5th antennal segment with the basal portion of the stem 2½ times its diameter, the distal portion 3 times its diameter; the 3d and 4th palpal segments equal................v i r i d i f l a v a n. sp., C. 606

bb Abdomen reddish or reddish brown

c The 5th antennal segment with the basal portion of the stem ½ its diameter, the distal portion with a length ½ greater than its diameter; the 4th palpal segment twice the length of the 3d; the dorsal plate triangularly incised. Bred from Taxodium
a n a n a s s i Riley, C. 926

cc 5th antennal segment with the basal portion of the stem with a length ¾ its diameter

d 5th antennal segment with the distal portion of the stem ½ longer than its diameter; the 4th palpal segment ½ longer than the 3d; the dorsal plate triangularly incised..........
hudsonici n. sp., C. 3

dd 5th antennal segment having the distal portion of the stem with a length twice its diameter; the 4th palpal segment about the length of the 3d. Bred from a purplish blister gall on Tulip ....liriodendri O. S.

ccc The 5th antennal segment with the distal portion of the stem as long as its diameter

d The 5th antennal segment with the distal portion of the stem ½ longer than its diameter; the 4th palpal segment twice the length of the 3d; the dorsal plate truncate, narrowly incised............truncata n. sp., C. 1202, 1203

dd The 5th antennal segment with the distal portion of the stem with a length 3 times its diameter; the 3d and 4th palpal segments equal; the dorsal plate triangularly and broadly emarginate. Bred from Clematis..................
clematidis n. sp., a1659b

cccc The 5th antennal segment with the basal portion of the stem with a length ¼ greater than its diameter; the 4th palpal segment a little longer than the 3d; the dorsal plate triangularly emarginate...............................viatica n. sp., C. 105a

ccccc The 5th antennal segment with the basal portion of the stem having a length ½ greater than its diameter

d The 5th antennal segment with the distal portion of the stem with a length equal to that of its diameter; the dorsal plate broadly and triangularly emarginate. Bred from sorghum seeds ....sorghicola Coq., C. 972

dd The 5th antennal segment of the distal portion of the stem with a length 3½ times its diameter; the 4th palpal segment ½ longer than the 3d; the dorsal plate triangularly incised.........................ampelophila Felt, C. 9

cccccc The 5th antennal segment with the 2 portions of the stem with a length 2½ times the diameter; the 4th palpal segment ¼ longer than the 3d; the dorsal plate triangularly incised........
balsamifera Felt, C. 143, 144, 169, 173, 174

bbb Abdomen brown or dark brown

c Abdomen light brown

d Wings unicolorous; the 5th antennal segment with the 2 portions of the stem each with a length about 2½ times its diameter; the circumfili long, slender, numerous; the 3d and 4th palpal segments equal. Bred from pear, Pyrus..
pyrivora Riley, C. 790, 959, 961, 997

dd Wings spotted with fuscous, the 5th antennal segment having the basal portion of the stem with a length ½ greater than its diameter, the distal part with a length 3 times its diameter; the circumfili with loops rather long and sparse and the 4th palpal segment a little longer than the 3d....
maculosa n. sp., C. 599

cc Abdomen dark brown or brownish black

d The 5th antennal segment with the basal portion of the stem having a length equal to its diameter, the distal portion of the stem with a length 3 times its diameter; the 4th palpal segment ½ longer than the 3d. Bred from Negundo...... [1] n e g u n d i f o l i a n. sp., C. 967

dd The 5th antennal segment with the 2 portions of the stem having a length ½ greater than the diameter; the 4th palpal segment ½ longer than the 3d. Bred from melon tip...... s e t i g e r a Lintn.

ddd The 5th antennal segment with the 2 parts of the stem having a length 2½ times greater than the diameter; the 4th palpal segment twice the length of the preceding. Probably bred from Fraxinus............................ c a n a d e n s i s n. sp., C. 1027

DICHRODIPLOSIS Kieff.

A few somewhat diverse species have been referred to this genus because they have all the claws unidentate. It is probable that several forms at least are not cogeneric with the type of the above named genus.

Key to species

a Abdomen fuscous yellowish, length 1.25 mm; fifth antennal segment having the stems with a length 3½ and 4½ times their diameters; palpi quadriarticulate; bred from a subglobular leaf gall on poplar............... p o p u l i n. sp., C. a1743

aa Abdomen reddish brown

b Fifth antennal segment having the stems with a length 2 and 3½ times their diameters; length 1.5 mm....a n d r o g y n e s n. sp., C. 6

bb Fifth antennal segment having the stems very short, the basal stem with a length only about ½ its diameter

c Antennal swellings elongate, coalescing; length 1.5 mm; probably bred from oak leaves.....(C e c i d o m y i a) q u e r c i n a Felt, C. 1006

cc Antennal swellings stout, well separated, length 1.5 mm.............. (C e c i d o m y i a) m u l t i f i l a Felt, C. 1024

BREMIA Rond.

This genus, like Aphidoletes, has the antennal setae and hairs greatly prolonged on the dorsal face. The male may be distinguished from all other Cecidomyiidae known to us by the low rudimentary circumfilum occurring on the base of the distal enlargement of the antennal segments [fig. 44]. The pulvilli are very short or rudimentary, the anterior claws only being uniden-

[1] Possibly the same as C e c i d o m y i a n e g u n d i n i s Gill.

tate. The wing is illustrated on plate 37, figure 3. The ventral plate in the male tapers distally presenting a very different appear-

Fig. 44 Bremia filicis Felt, 5th antennal segment of male, much enlarged. (Original)

ance from that obtaining in Aphidoletes. Members of this genus are said by Kieffer to be xylophagous.

Key to species

a Abdomen yellowish brown, the segments margined posteriorly with pale fuscous, antennal segments with the distal portion of the stem markedly longer than the basal portion..........podophyllae Felt, C. 352

aa Abdomen fuscous, clothed with long hairs, antennal segments with the 2 portions of the stem nearly equal..............filicis Felt, C. 397

aaa Abdomen dark fuscous yellow, the terminal segments pale orange, the 2 portions of the stem nearly equal, the length fully 3 times the diameter caricis n. sp., C. 292

APHIDOLETES Kieff.

Aphidoletes and Bremia are peculiar in that the setae and circumfili of the male antennae are greatly produced on the dorsal face. This genus is easily separated from Bremia by the three well developed circumfili [fig. 45]; and by the pulvilli being long, usually over one half the length of the claw. The

Fig. 45. Aphidoletes hamamelidis Felt, 5th antennal segment of male, much enlarged. (Original)

ventral plate in the male is expanded distally and the anterior and midclaws are strongly unidentate; the posterior claws are simple. The wing is shown on plate 37, figure 4.

All of the species of Aphidoletes presumably live at the expense of aphids or plant lice.

Key to species

a Legs very slender with a length 2½ or 3 times that of the body; tibiae distinctly though slightly swollen apically

b Posterior tibia as long as the femora, the 2d tarsal segment longer than tibia; body fuscous, the abdomen thickly clothed with pale hairs.................(Bremia) hamamelidis Felt, C. 401

bb Posterior tibia shorter than the femora

c Abdomen dark brown; scutellum reddish brown................ marginata n. sp., C. 1224

cc Abdomen reddish brown; scutellum light brown............... fulva n. sp., C. 530

ccc Abdomen reddish brown; scutellum light yellow recurvata n. sp., C. 825

aa Legs rather stout, with a length rarely twice that of the body; tibiae not distinctly swollen apically

b Posterior tibia nearly as long as the femora

c 2d tarsal segment of posterior legs longer than the tibia. Abdomen reddish brown; scutellum pale yellowish brown, legs yellowish brown...............meridionalis n. sp., C. 1005

cc 2d tarsal segment of posterior legs almost as long as tibia; abdomen grayish, thickly haired; scutellum yellowish; legs light brown........(Diplosis, Bremia) cucumeris Lintn.

bb Posterior tibia ¾ the length of femora

c 2d tarsal segment of posterior legs longer than tibia and 1st tarsal segment

d Abdomen pale reddish orange; scutellum yellowish basally, red apically; legs fuscous yellow....flavida n. sp., C. 666

dd Abdomen fuscous yellow; scutellum light fuscous yellow; legs light brown..................borealis n. sp., a1160

cc 2d tarsal segment of posterior legs as long as tibia and the 1st tarsal segment

d 3d tarsal segment of posterior legs ½ the length of the 2d. Abdomen dark reddish brown; scutellum reddish orange... marina n. sp., C. 581

dd 3d tarsal segment of posterior legs more than ½ length of 2d segment. Abdomen yellowish brown, the basal segment fuscous brown, scutellum yellowish red................... basalis n. sp., a1722

LOBODIPLOSIS n. g.

This genus is erected for certain small, orange or yellowish orange species having the anterior claws unidentate and the third vein uniting with costa well beyond the apex [pl. 38, fig. 8]. The palpi are quadriarticulate and the basal clasp segment lobed, the terminal clasp segment being slender and subapical [pl. 40]. The harpes are strongly curved and heavily chitinized. The wings are illustrated on plate 38, figures 3, 4. Type, Mycodiplosis acerina Felt.

Nothing is known concerning the life history of members of this genus, though it would not be surprising if they, like the allied My-

codiplosids, breed largely in fungi. The type species is evidently widely distributed and persists through a considerable part of the growing season.

Key to species

a Basal clasp segment with the apical lobe broadly rounded, smooth........
(Mycodiplosis) acerina Felt, C. 243, 269, 270, 548, 688, 699

aa Basal clasp segment with a long, setose lobe apically
(Mycodiplosis) quercina Felt, C. 271

COQUILLETTOMYIA n. g.

This genus is allied to Mycodiplosis, since it has the anterior tarsal segments unidentate. It may be separated therefrom by the conspicuous setose basal lobe at the internal angle of the basal clasp segment. The ventral plate is about as long as the style and broadly rounded apically, while the harpes are strongly chitinized.

Type Mycodiplosis lobata Felt.

Key to species

a Abdomen dark salmon, the internal lobe of the basal clasp segment short, broad, naked, the ventral plate slightly emarginate; harpes inconspicuous.................(Mycodiplosis) lobata Felt, C. 176

aa Abdomen yellowish, the internal lobe of the basal clasp segment short, stout, setose, the ventral plate broadly rounded; harpes short, spined apically...................................texana n. sp., C. a1728

aaa Abdomen light brown, the internal lobe of the basal clasp segment long, setose; ventral plate broadly rounded; harpes long, terminating in a heavy, curved, chitinous process.............dentata n. sp., C. 622

KARSHOMYIA n. g.

The form referable to this genus is a small, yellowish brown banded species allied to Lobodiplosis Felt and easily distinguished therefrom by the unique genitalia. The stout basal clasp segment bears a broadly dilated, subfusiform terminal clasp segment; the harpes are strongly chitinized and very complex [pl. 41, fig. 1]. The wing is shown on plate 38, figure 7. Type and sole species, Mycodiplosis viburni Felt, Cecid. 89.

YOUNGOMYIA n. g.

This genus comprises several rather large, brownish Diplosids allied to Mycodiplosis and distinguished therefrom by the peculiar genitalia. The terminal clasp segment is greatly produced, being distinctly longer than the basal clasp segment, which latter has a

prominent lobe at its internal basal angle. The dorsal plate is almost divided; the roundly truncate ventral plate is thickly haired apically and the style is rather stout, clavate [pl. 41, fig. 2]. Type D i c r o d i p l o s i s p o d o p h y l l a e Felt.

Fig. 46 K a r s h o m y i a v i b u r n i Felt, antennal segment of male, much enlarged. (Original)

Nothing is known concerning the life history of the species referable to this genus, though it would not be surprising if later studies showed that they subsisted upon fungi, though it is possible that they are zoophagous.

Key to species

a Abdomen reddish brown, the basal clasp segment with the internal basal lobe subquadrate..(D i c r o d i p l o s i s) p o d o p h y l l a e Felt, C. 207

aa Abdomen dark red, the basal clasp segment with the internal basal lobe triangular.................................r u b i d a n. sp., C. 423

MYCODIPLOSIS Rubs.

This genus comprises a large number of small, yellowish or light brown forms presenting very much the same general appearance and yet differing considerably in structural characters. The anterior claws are unidentate and the third vein as a rule joins the margin of the wing beyond the apex. We have referred to this group a considerable number of forms having a more or less uniform structure and not referable to such recently erected genera as Karshomyia, Lobodiplosis, Youngomyia and Coquillettomyia, all of which are separated from this large genus by well marked structural characters.

Key to species

a Third vein uniting with costa well before the apex
  b Harpes indistinct, not lobelike
    c Abdomen pale yellowish; ventral plate rather long, broadly emarginate, the basal portion of the stem of the 5th antennal segment with a length ½ greater than its diameter..r e d u c t a n. sp., C. 479
  bb Harpes lobulate, distinct
    c Harpes setose
      d Abdomen reddish brown; ventral plate short, truncate, the basal portion of the stem of the 5th antennal segment with a length twice its diameter......................m i n u t a Felt, C. 290
    cc Harpes strongly spined, the basal portion of the stem of the 5th antennal segment with a length ½ greater than its diameter
      d Abdomen yellowish transparent; scutellum reddish brown........ a c e r i f o l i a Felt, C. 37
      dd Abdomen dark reddish brown; scutellum a pale fuscous yellowish p i n i Felt, C. 348
aa Third vein uniting with costa beyond the apex
  b Ventral plate long, at least ⅔ the length of the style
    c Ventral plate expanded apically, broadly and deeply emarginate
      d Dorsal plate long
        e Lobes greatly expanded distally, spatulate; abdomen yellowish, length .75 mm....(C e c i d o m y i a) a n g u l a t a Felt, C. 332a (Syn. C. u r t i c a e Felt 123)
        ee Lobes long, not greatly expanded laterally, narrowly rounded apically
          f Abdomen yellowish brown, reddish brown basally, length .75 mm, the fifth antennal segment having the stems 2 and 2½ times their diameters; bred from folded, thickened cherry leaves....(C e c i d o m y i a) c e r a s i f o l i a Felt, C. a1571
          ff Abdomen light yellowish, reddish basally, length 1 mm; 5th antennal segment having the stems 2½ and 4 times their diameters; bred from globular leaf gall on poplar.......... p o p u l i f o l i a n. sp., C. a1514

fff Abdomen pale yellowish, orange tinted basally, length 1.5 mm; fifth antennal segment having the stems 3 and 4 times their length; bred from fungus on Impatiens, Oecidium impatientis..........impatientis n. sp., C. a1542

dd Dorsal plate short, broad, the lobes broadly rounded and margined with setae; ventral plate deeply and triangularly emarginate, the lobes slender, the basal portion of the stem of the 5th antennal segment with a length 2½ times its diameter....................
rotundata n. sp., C. 634, 704, 564

ddd Dorsal plate with the lateral angles produced, the lobes roundly emarginate

e Basal portion of the stem of the 5th antennal segment with a length ¼ greater than its diameter

f The lobes of the dorsal plate deeply and roundly emarginate, the antennae plainly trinodose.............................
holotricha n. sp., C. 1104a, 1110a, a1821b

ee Basal portion of the stem of the 5th antennal segment with a length twice its diameter

f Dorsal plate long, deeply and roundly emarginate; antennae not trinodose..................corylifolia Felt, C. a1543b

eee Fifth antennal segment having the basal portion of the stem with a length thrice its diameter

f The lobes of the dorsal plate broadly not deeply emarginate

g Ventral plate deeply and triangularly emarginate, the lobes slender........................tenuitas n. sp., C. 306

gg Ventral plate broadly and roundly emarginate, the lobes stout..........................robusta n. sp., C. 1210

cc Ventral plate broadly and slightly emarginate

d Fifth antennal segment having the basal portion of the stem with a length thrice its diameter, the dorsal plate short, with the lateral angles narrowly produced, the lobes roundly emarginate
cyanococci Felt, C. 136

dd Fifth antennal segment having the basal portion of the stem with a length equal to its diameter, the dorsal plate short, the lateral angles broadly produced..................contracta, C. 671

ccc Ventral plate tapering distally, broadly and deeply emarginate

d Terminal clasp segment as long as the basal clasp segment

e Fifth antennal segment having the basal portion of the stem with a length four times its diameter, the dorsal plate truncate......
fibulata n. sp., C. 684

dd Terminal clasp segment distinctly shorter than the basal clasp segment

e Fifth antennal segment having the basal portion of the stem with a length three to four times its diameter

f Abdomen fuscous yellowish with the ventral plate narrow, the distal enlargement of the 5th antennal segment with a length 2½ times its diameter, stout and constricted at the basal third
captiva Felt, C. 197

ff Abdomen light brown, the ventral plate broad, the 5th antennal segment having the distal enlargement with a length ½ greater than its diameter and constricted at the basal third..........
a e s t i v a n. sp., C. 389

fff Abdomen light brown, the ventral plate narrow, the 5th antennal segment having the distal enlargement with a length ½ greater than its diameter and not constricted at the basal third.............................o b s c u r a n. sp., C. 204

cc Fifth antennal segment having the basal portion of the stem with a length 2½ times its diameter, the distal enlargement with a length ¾ greater than its diameter, the lobes of the dorsal plate obliquely truncate; abdomen fuscous yellowish...............
v a r i a b i l i s n. sp., C. 652

ccc Fifth antennal segment having the basal portion of the stem with a length ½ greater than its diameter, the distal enlargement with a length ¼ greater than its diameter, the lobes of the dorsal plate truncate; abdomen fuscous brown. ....
m o d e s t a n. sp., C. 289

cccc Ventral plate broadly rounded apically, the 5th antennal segment having the basal portion of the stem with a length 2½ times its diameter, the abdomen fuscous yellowish....t s u g a e Felt, C. 168a

bb Ventral plate rather short, about ½ the length of the style or of the basal clasp segment if the style is short

c Ventral plate deeply emarginate

d Fifth antennal segment having the basal portion of the stem with a length 2½ times its diameter, the abdomen yellowish orange....
e m a r g i n a t a Felt, C. 191, 438, 695

cc Ventral plate broad, broadly and slightly emarginate

d Fifth antennal segment having the basal portion of the stem with a length twice its diameter

e The dorsal plate narrowly incised, the abdomen a mottled brown
a l t e r n a t a Felt, C. 209, 205, 220

ee Dorsal plate triangularly incised, the abdomen a reddish carmine.................................h u d s o n i Felt, C. 188

dd Fifth antennal segment having the basal portion of the stem with a length ½ greater than its diameter

e Abdomen pale orange, the distal enlargement of the 5th antennal segment with a length ¼ greater than its diameter............
c o r y l i Felt, C. 237

ee Abdomen bright orange, the distal enlargement of the fifth antennal segment with a length twice its diameter...........
p e r p l e x a n. sp., C. 554

ccc Ventral plate broadly truncate

d Dorsal plate narrowly incised, the lobes rather broad; abdomen brownish orange.........................a u r a t a n. sp., C. 212

dd Dorsal plate narrowly incised, the lobes narrow and narrowly rounded; abdomen dark brown..........s i l v a n a n. sp., C. 255

cccc Ventral plate broadly rounded apically
d Dorsal plate short, deeply and narrowly incised, the lobes broadly rounded; 5th antennal segment having the basal portion of the stem with a length 3½ times its diameter...................... (Cecidomyia) acarivora Felt, C. 847

PRODIPLOSIS n. g.

This genus is erected for the reception of certain small forms which display, in a most interesting manner, the transition between the typical binodose antennae of the male Diplosid and the cylindric stemmed antennae of Rhopalomyia. The circumfili are rudimentary or wanting. The third to ninth segments are distinctly binodose, the eighth and ninth only slightly so, while the 10th to the 14th are cylindric. The claws are simple. The third vein unites with the wing margin well beyond the apex. The genitalia are peculiar, in that the harpes are somewhat inflated.

Type Cecidomyia floricola Felt, C. a1681.

Apparently the same species has been bred from enlarged blossoms of clematis under the number a1694.

ARTHROCNODAX Rubs.

This genus comprises a number of small, yellowish forms having simple claws and most easily recognized by the third vein uniting with the costa well before the apex. It is probable that most of the species are zoophagous, though A. apiphila is known to subsist upon organic debris in beehives.

Key to species

a Ventral plate broadly rounded apically
b Ventral plate long, rather narrow
c Dorsal plate short, deeply and narrowly incised
d Stems of 5th antennal segment nearly equal, each with a length thrice the diameter; abdomen orange brown, length .75 mm..... (Cecidomyia) incisa Felt, C. 67
dd Fifth antennal segment with the stems subequal, each with a length 2½ and 4 times the diameter; abdomen dark carmine with a fuscous spot, length 1.2 mm.................................. (Cecidomyia) sylvestris Felt, C. a1630
cc Dorsal plate long, broadly and triangularly emarginate
d Fifth antennal segment with the stems nearly equal, each with a length 2½ and 3 times the diameter; abdomen dark red, length 1 mm....................................rufa n. sp., C. 678
bb Ventral plate long, rather broad
c Dorsal plate broadly and triangularly emarginate

d Fifth antennal segment with the stems subequal, each with a length 2½ and 3½ times the diameter; abdomen yellowish brown, length 1 mm............(Cecidomyia) filicis Felt, C. 139, 538

cc Dorsal plate short, broadly and triangularly emarginate

d Fifth antennal segment with the stems equal, each with a length 2½ times the diameter; abdomen dark red, length 1 mm........ (Cecidomyia) fraxini Felt, C. 179

bbb Ventral plate rather short, broad

c Dorsal plate rather long, broad, deeply and triangularly emarginate

d Basal clasp segment with a rounded lobe basally; abdomen yellowish brown, length 1 mm..(Cecidomyia) acerina Felt, C. 149

dd Basal clasp segment without a basal lobe internally; abdomen light yellowish brown, length 1 mm........fenestra n. sp., C. 641

cc Dorsal plate rather long, narrowly incised

d Abdomen fuscous, length .75 mm........obscura n. sp., C. 399

bbbb Ventral plate rather short, narrow, narrowly rounded apically

c Dorsal plate short, broadly and triangularly emarginate

d Fifth antennal segment having the basal portion of the stem with a length ¾ its diameter or less

e Abdomen yellowish or dark carmine, length 1 mm; third palpal segment slender ....apiphila Felt, C. a1775, 524

ee Abdomen reddish brown, length 1 mm; third palpal segment broadly oval...(Cecidomyia) macrofila Felt, C. 1023

aa Ventral plate truncate

b Dorsal plate short, deeply and triangularly incised; abdomen pale yellowish, length .5 mm; bred from heads of curled sumac leaves.... rhoina n. sp., C. a1720b

bb Dorsal plate very short, deeply and narrowly emarginate, length 1 mm; bred from rolled elder leaves...sambucifolia n. sp., C. a1723

ODONTODIPLOSIS n. g.

This genus is erected for the separation of certain species allied to Cecidomyia, which may be distinguished therefrom by the triarticulate palpi and the conspicuous serrations on the somewhat conical ventral plate or harpes.

Type Cecidomyia karnerensis Felt, C. 27.

Key to species

a Fifth antennal segment having the basal portion of the stem with a length about ½ greater than its diameter

b Length .75 mm; abdomen reddish yellow (Cecidomyia) karnerensis Felt, C. 27

aa Fifth antennal segment having the basal portion of the stem with a length 2½ or 3 times that of the diameter

b Abdomen pale orange ....americana n. sp., C. 451, 660

bb Abdomen fuscous yellowish ....montana n. sp., C. 718

ADIPLOSIS n. g.

This genus is easily distinguished from Odontodiplosis Felt, to which it is closely related, by the stouter basal clasp segment and the total absence of teeth on the ventral plates or harpes.

Type and sole species Cecidomyia toxicodendri Felt, C. 263.

HYPERDIPLOSIS n. g.

This genus is erected for a form with simple claws bent at right angles and with a very long, broad, and very deeply and broadly emarginate ventral plate. The dorsal plate is deeply and roundly emarginate, the lobes being broadly emarginate and with the lateral angles greatly produced.

Type and sole species Cecidomyia lobata Felt, C. 132.

GIARDOMYIA n. g.

This genus is erected for certain species doubtfully referred to Octodiplosis Giard. These forms, however, present marked differences from the type of this older genus and a new genus has therefore been founded.

The genus Giardomyia comprises a number of small, yellowish or reddish forms having the simple claws bent almost at right angles and usually somewhat enlarged subapically. The ventral plate is long, slender, slightly expanded apically and roundly emarginate, while the dorsal plate is short, triangularly emarginate and with the somewhat long lobes broadly rounded or even truncate. The type species is G. photophila Felt [pl. 38, fig. 2].

Key to species

a Abdomen yellowish
- *b* Abdomen pale yellowish
  - *c* Length .75 mm, the 5th antennal segment having the stems 2½ and 3½ times their length; presumably bred from a pustulate gall on Mentha........................menthae n. sp., C. a1578b, 536
- *bb* Abdomen fuscous yellowish, length 1 mm; 5th antennal segment having the stems 3 and 4½ times the length of their diameters............. noveboracensis n. sp., C. 197x

aa Abdomen reddish
- *b* Abdomen bright carmine, length 1 mm; 5th antennal segment having the stems 3 and 4½ times the length of their diameters............. (Cecidomyia) photophila Felt, C. 323
- *bb* Abdomen bright red; terminal segments yellowish, length 1 mm; 5th antennal segments having the stems with a length 3 and 3½ times their diameters, the ventral plate deeply and narrowly emarginate.. emarginata n. sp., C. 446

bbb Abdomen deep reddish, length 1 mm; 5th antennal segment having the stems 2½ and 4 times the length of their diameters .... hudsonica n. sp., C. 200

bbbb Abdomen dark reddish brown, length 1 mm; 5th antennal segment having the stems 2½ and 3½ times the length of their diameters.. montana n. sp., C. 325, 585

METADIPLOSIS n. g.

This genus is easily distinguished from the ordinary type of Cecidomyia by the unique genitalia, the basal clasp segment being short, stout, broadly rounded and with conspicuous triangular, chitinous processes at the internal angles, while the terminal clasp segment is short, greatly constricted near the middle, enormously swollen and recurved apically.

Type and sole species Metadiplosis spinosa n. sp.

Metadiplosis spinosa n. sp.

Male. Length 1 mm. Antennae dark brown, the basal segments yellowish. Mesonotum dark brown, the submedian lines indistinct. Scutellum reddish yellow, postscutellum reddish brown. Abdomen light reddish brown, rather thickly clothed with pale setae and slightly fuscous distally. Wings hyaline, halteres yellowish basally, semitransparent apically. Legs a nearly uniform dark brown.

Taken at Albany, N. Y., July 14, 1906, on quack grass.

Type C. 573, N. Y. State Museum.

EPIDIPLOSIS n. g.

This genus is erected for a species remarkable because of the enormously produced, curved, setose-bearing spine on the basal clasp segment, this peculiar organ being nearly as long as the terminal clasp segment and strongly suggesting the genitalic modification we find in Lobodiplosis. It is, however, readily separable from this last named genus by the simple claws.

Type and sole species Epidiplosis sayi n. sp., C. 429.

Epidiplosis sayi n. sp.

Male. Length 6 mm. Antennae light brown, yellowish basally; face fuscous yellowish. Mesonotum fuscous brown, the submedian lines narrow. Scutellum reddish brown, postscutellum yellowish, the basal and terminal abdominal segments yellowish orange, the

third, fourth and fifth being white, all sparsely haired. Wings hyaline. Legs a nearly uniform dull brown.

Taken at Nassau, N. Y., July 1, 1906.

Type C. 429, N. Y. State Museum.

LESTODIPLOSIS Kieff.

This genus, as recognized by us, is easily separated from all other Diplosids by the very characteristic triangular lobe at the base of the slender basal clasp segment. The dorsal plate is rather long, rather deeply and triangularly emarginate, the lobes being nearly parallel and broadly rounded, while the ventral plate is long, rather broad and narrowly rounded apically. Species referable to this group are rather small, ranging from .75 to about 2 mm in length, usually yellowish or reddish, though a few are brownish.

Species of this genus are very frequently bred from various galls and in certain cases at least, are probably zoophagous. This is undoubtedly true of L. grassator Fyles, and presumably so of a number of other species, though it will be observed by referring to the following records, that a considerable number of species have been bred from flowers or rolled leaves. These may be entirely responsible for the vegetable deformities or partly so, living as commensals, or it is possible that they may be the cause of certain malformations. It is impossible, in the present state of our knowledge, to make definite statements respecting the habits of these species. It is worthy of notice, however, that those reared from different plants, present variations which lead us to regard them as distinct species. Certain species in the following table are given in two divisions as having the wings either hyaline or spotted. This is due to the fact that it is very difficult to draw a sharp line between spotted and unspotted wings in cases where there are numerous gradations. Furthermore, females which are not represented in the following table, frequently have spotted wings, while their consorts have the organs of flight hyaline. This character, though variable, is a very convenient one upon which to make primary divisions.

Key to species

a Wings hyaline

b Wings narrow, the length thrice the width

c Abdomen brownish

d Abdomen yellowish brown, the stems of the 5th antennal segment with a length 3½ times the diameter, the distal node with a length ¼ greater than its diameter; bred from fusiform galls on cherry twigs ....cerasi n. sp., C. a1593a

dd Abdomen dark brown, the 5th antennal segment having the stems with a length 3½ times the diameter, the distal node with a length equal to its diameter, circumfili long ....
(Cecidomyia) juniperina Felt, C. 746

cc Abdomen yellowish

d Abdomen pale yellowish, the 5th antennal segment having the stems with a length thrice the diameter, the distal node with a length ⅓ greater than its diameter, circumfili rather long; bred from a cylindric fimbriate leaf gall on Crataegus ....
crataegifolia n. sp., C. a1555

dd Abdomen yellowish, the second to fourth segments fuscous, the 5th antennal segment having the stems with a length 2½ times the diameter, the distal node with a length ½ greater than its diameter, style short......................cincta n. sp., C. 465

ddd Abdomen fuscous yellowish

e Style short, the 5th antennal segment having the stems with a length 2½ times the diameter, the distal node with a length ½ greater than its diameter, not constricted; bred from rolled edge of poplar leaf..........populifolia n. sp., C. a1490

ee Style long, the 5th antennal segment having the stems with a length 3½ times the diameter, the distal node with a length ⅓ greater than its diameter, constricted; bred from rolled ash leaves ....fraxinifolia n. sp., C. a1572

dddd Abdomen fuscous yellowish, fuscous basally, 5th antennal segment having the stems with a length 2½ times the diameter, the distal node with a length ½ greater than its diameter, the style short; dorsal plate slightly emarginate, the lobes broadly emarginate ....basalis n. sp., C. 512

ccc Abdomen light carmine, the 5th antennal segment having the stems with a length 2½ times the diameter, the distal node with a length ½ greater than its diameter; style long; bred from rolled Verbena urtifolia leaves..verbenifolia n. sp., C. a1577a

bb Wings moderate, with a length about 2½ times the width

c Abdomen light brown

d Fifth antennal segment having the stems with a length 3½ times the diameter, the distal node with a length equal to its diameter..
(Cecidomyia) flavomarginata Felt, C. 109

dd Fifth antennal segment having the stems with a length thrice the diameter, the distal node with a length ¼ greater than its diameter

e Wings medium, with a length 2½ times the width, circumfili moderate; bred from Phylloxera vastatrix galls....
grassator Fyles, C. 962, 963, 974

ee Wings broad, with a length only 2⅛ times the width; circumfili heavy; bred from pods of Yucca angustifolia.......
yuccae n. sp., C. 1017

cc Abdomen yellowish

d Abdomen pale yellowish

e Basal stem of the 5th antennal segment with a length 3½ times its diameter

f Distal stem of 5th antennal segment with a length thrice its diameter, the circumfili stout, rather long; bred from Solidago leaf with elongate, brown spots ....
s o l i d a g i n i s n. sp., C. a1655
ff Distal stem of 5th antennal segment with a length 3½ times its diameter, circumfili rather long ....
(C e c i d o m y i a) h i c o r i a e Felt, C. 261
cc Basal stem of the 5th antennal segment with a length 2½ times its diameter
f Distal stem of 5th antennal segment with a length 3½ times its diameter, the circumfili short; bred from distorted flower buds of figwort, S c r o p h u l a r i a m a r y l a n d i c a......
(C e c i d o m y i a) s c r o p h u l a r i a e Felt, C. a1569
dd Abdomen fuscous yellowish, 5th antennal segment with the stems 3½ times their diameters
e Abdomen fuscous yellowish
f Style long
g Distal node of 5th antennal segment with a length ¼ greater than its diameter; bred from flowers of dogbane ....
a p o c y n i f l o r a e n. sp., C. a1684
gg Distal node of 5th antennal segment with a length ½ greater than its diameter; bred from subglobular leaf gall on poplar
g l o b o s a n. sp., C. a1656
ff Style short, the lobes of the basal clasp segment slightly rounded, the distal node of the 5th antennal segment with a length ½ greater than its diameter ....
(C e c i d o m y i a) t s u g a e Felt, C. 168b
ddd Abdomen reddish
e Abdomen reddish fuscous, the 5th antennal segment with the stems 3½ and thrice their diameters, the distal node with a lenth ¼ greater than its diameter; bred from rolled milkweed (Asclepias) leaves..............a s c l e p i a e n. sp., C. a1588
ee Abdomen reddish brown, the 5th antennal segment with the stems 3½ times their diameters, the distal node with a length ¼ greater than its diameter.................................
(C e c i d o m y i a) r u g o s a Felt, C. 650c
eee Abdomen reddish, 5th antennal segment with the stems 3 and 3½ times their diameters, the distal node with a length ¼ greater than its diameter; bred from Clematis flowers ....
c l e m a t i f l o r a e n. sp., C. a1694b
aa Wings spotted
b Legs broadly white-banded, the 5th antennal segment having the stems with a length 2½ times their diameter, the ventral plate coarsely setose apically; bred from thorn leaf........f l o r i d a n. sp., C. 986
bb Legs not broadly white-banded
c Abdomen yellowish
d Basal segment dark brown or black ....
(C e c i d o m y i a) c a r o l i n a e Felt, C. a1636
dd Abdomen orange tinted, the 5th antennal segment having the stems with a length 3½ times their diameters, the distal node with a length ¼ greater than its diameter

e Wings medium, with a length 2½ times the width; bred from Eupatorium ageratoides ....
(Cecidomyia) eupatorii, C. a1280

ee Wings broad, with a length 2½ times the width; bred from plane (Platanus leaf)............platanifolia n. sp., C. a1669a

ddd Abdomen reddish apically, the 5th antennal segment having the stems with a length 3½ times their diameters, the distal node with a length ¼ greater than its diameter ....
(Cecidomyia) asteris Felt, C. 615

dddd Abdomen red tinted, the 5th antennal segment having the stems with a length 3½ times their diameters

e Wings moderate, with a length 2½ times the width; bred from Rumex ....rumicis n. sp., C. a1595a

ee Wings rather narrow, with a length 2¾ times the width; bred from thickened leaf fold on Spiraea tomentosa......
spiraeafolia n. sp., C. 760 (a1174)

ddddd Abdomen brown tinted, the 5th antennal segment having the stems with a length thrice the diameters, the distal node with a length greater than its diameter; bred from Solidago............
(Cecidomyia) triangularis Felt, C. 763 (a1170)

cc Abdomen dark red, the tarsi faintly banded

d Fifth antennal segment having the stems with a length 2½ times the diameters; bred from rolled milkweed leaf..................
asclepiae n. sp., C. a1588a

dd Fifth antennal segment having the stems 3 and 3⅓ times their length; bred from galls of Phylloxera vastatrix......
grassator Fyles, C. a1654

PARADIPLOSIS n. g.

This genus is separated from Cecidomyia principally because of the peculiar structures presented by the male genitalia. The basal clasp segment is short, stout and broad, while the terminal clasp segment is short, stout and apically with a broad, chitinized serrate margin. The dorsal and ventral plates are short, broad, each rather deeply and narrowly emarginate; style short, stout. The third vein unites with the margin at the apex of the wing. The palpi are quadriarticulate and the claws simple.

Type and sole species Cecidomyia obesa Felt.

OBOLODIPLOSIS n. g.

This genus has been erected to include a remarkable form which diverges widely from the ordinary type of Cecidomyia in the male genitalia. The terminal clasp segments are greatly produced, being nearly ½ longer than the basal clasp segment. The dorsal plate is greatly expanded, nearly divided, the lobes being orbicular, while the

ventral plate appears to be widely separated, the two lobes being short, stout and roundly triangular [pl. 42, fig. 2]. The male is 3 mm long, the flagellate antennal segments are strongly trinodose, while the claws are simple and the third vein unites with the margin well beyond the apex.

Type and sole species Cecidomyia orbiculata Felt.

CLINODIPLOSIS Kieff.

Members of this genus are small, yellowish species which may be recognized by the simple claws, the quadriarticulate palpi, the lack of a conspicuous lobe or spine on the basal clasp segment and by the long, linear, narrowly rounded, ventral plate [pl. 42, fig. 1]. The species probably breed mostly in leaf galls, though C. cattleyae was reared from the roots of Cattleya gigas.

Key to species

a Ventral plate long, slender, tapering slightly and narrowly rounded apically
  b Antennal segments with only two distinct enlargements, not trinodose
    c Abdomen dark brown, length .75 mm.............................. (Cecidomyia) rubrascuta Felt, C. 93
    cc Abdomen yellowish brown, length 1 mm; bred from leaves of scrub oak ....florida n. sp., C. 978
  bb Antennal segments more or less distinctly trinodose
    c Fifth antennal segment having the basal portion of the stem with a length twice its diameter
      d Abdomen pale orange, length 1.5 mm........................... (Cecidomyia) acernea Felt, C. 267
    cc Fifth antennal segment having the basal portion of the stem with a length ½ greater than its diameter
      d Abdomen yellowish, the segments banded posteriorly and partially near the middle with brown
        e Length 2.5 mm, 5th antennal segment stems with a length 1½ and 3 times the diameters, distal node strongly constricted; bred from globose gall on hickory .... (Cecidomyia) caryae Felt, C. 331, 1117
        ee Length 1.5 mm, 5th antennal segment stems with a length 1½ and 2½ times the diameters, distal node not strongly constricted (Cecidomyia) coryli Felt, C. 216
aa Ventral plate long, slender, tapering distally
  b Dorsal plate rather long, triangularly emarginate, the lobes long and narrowly triangular
    c Abdomen pale yellowish or carmine, length 1 mm; 5th antennal segment having the stems with a length 2½ and 4 times the diameters, respectively...................triangularis n. sp., C. 428, 499
aaa Ventral plate long, rather stout, broadly rounded apically
  b Dorsal plate short, the lobes truncate

c Abdomen dark red, the segments margined with fuscous, length 1 mm; 5th antennal segment having the stems with a length 2¼ and 4 times that of the diameters, respectively, trinodose
(Cecidomyia) subtruncata Felt, C. 506

cc Abdomen fuscous brown, length 1 mm; 5th antennal segment having the stems with a length 1½ and 3 times that of the diameters, respectively............................montana n. sp., C. 631

aaaa Ventral plate long, emarginate

b Ventral plate tapering distally, roundly emarginate

c Dorsal plate short, roundly emarginate, the 5th antennal segment having the stems with a length 1½ and 2½ times that of the diameters; bred from roots of Cattleya gigas ....
cattleyae n. sp., C. 979

cc Dorsal plate short, narrowly and triangularly emarginate, the lobes produced laterally; abdomen yellowish, length 1 mm; 5th antennal segment having the stems with a length 2½ and 3½ times that of the diameters.........rubisolita n. sp., C. 656

bb Ventral plate long, slender, broadly emarginate

c Dorsal plate triangularly emarginate, the lobes truncate

d Abdomen reddish brown, length .75 mm; 5th antennal segment having the stems with a length 3 and 4 times that of the diameters............................extensa n. sp., C. 228

bbb Ventral plate long, broad, scarcely tapering, very broadly emarginate

c Dorsal plate short, triangularly emarginate, the lobes truncate

d Abdomen a fuscous reddish brown, length 1.5 mm; 5th antennal segment having the stems equal, each with a length 3½ times its diameter ....pratensis n. sp., C. 741

dd Abdomen reddish brown, length 1.25 mm; 5th antennal segment having the stems with a length 1½ and 2½ times that of the diameters..........(Cecidomyia) carpini Felt, C. 347

CECIDOMYIA Meig.

This, the oldest genus of the group, originally included all forms referable to this family. It is at present restricted to a large number of Diplosids having simple claws, the third vein uniting with costa beyond the apex and not presenting characters given for the preceding genera. The members of this group appear to live largely in leafy tissues, though one form, Cecidomyia resinicola O. S., occurs in exuded pitch masses. This genus includes the wheat midge, Cecidomyia tritici Kirby, a species of prime economic importance.

Key to species

a Ventral plate long

b Ventral plate broadly and roundly emarginate, the lobes diverging strongly

c Fifth antennal segment having the basal portion of the stem with a length less than its diameter, the circumfili indistinct or wanting

d Abdomen fuscous yellowish, length .75 mm, 5th antennal segment with the stems ½ and 2½ the length of their diameters .... infirma n. sp., C. 299

dd Abdomen yellowish brown, length .75 mm, 5th antennal segment with the stems ¾ and 1¼ the length of their diameters .... paucifili n. sp., C. 297

cc Fifth antennal segment having the basal portion of the stem with a length greater than its diameter, the circumfili distinct

d Abdomen pale yellowish, 5th antennal segment with the stems nearly equal, each 3½ times the diameter

e Length 1.5 mm; dorsal plate triangularly emarginate, the lobes broadly truncate............americana n. sp., C. 420, ?694

ee Length 1 mm; dorsal plate lobes diverging, rounded............ recurvata Felt, C. 361

eee Length .75 mm; dorsal plate roundly emarginate, the lobes hardly diverging, obliquely truncate........fragariae Felt, C. 328

bb Abdomen yellowish red, length .75 mm; dorsal plate short, triangularly emarginate, the lobes obliquely truncate; 5th antennal segment having the stems 2½ and 3 times their diameters........................ emarginata Felt, C. 421, 34

dd Abdomen dark brown, length 1 mm; 5th antennal segment having the stems 2½ and 3 times their diameters. ruricola n. sp., C. 293

bb Ventral plate deeply and roundly emarginate, the lobes not diverging strongly

c Fifth antennal segment having the stems equal or nearly so

d Lobes of the ventral plate diverging apically

e Abdomen dark brown, length 1 mm; 5th antennal segment having the stems each with a length 3½ times its diameter............ apicalis n. sp., C. 409, 367

dd Lobes of the ventral plate nearly parallel, not diverging apically

e Lobes of the dorsal plate not strongly diverging

f Abdomen pale yellowish orange or yellowish brown, length 1 mm; 5th antennal segment having the stems each with a length 3½ times its diameter.............................. agraria n. sp., C. 247, 621, 626, 632

ff Abdomen dark yellowish brown, length .75 mm; 5th antennal segment having the stems with a length 3 and 3½ times their diameters ....terrestris n. sp., C. 371

fff Abdomen dull red, length 1 mm; 5th antennal segment having the stems each with a length 3½ times the diameter; the 4th palpal segment as long as the 3d .... sanguinia n. sp., C. 385

ee Lobes of the dorsal plate strongly divergent

f Abdomen pale yellowish, length 1.25 mm, the 4th palpal segment ¾ longer than the third, the 5th antennal segment having the two parts of the stem with a length 3 and 3½ times their diameters; dorsal plate lobes very large, divergent, the distal third setose and as long as the ventral plate .... explicata n. sp., C. 515

ff Abdomen bright orange, length 1 mm; dorsal plate lobes divergent, distinctly constricted subapically and bearing a few stout setae apically; ventral plate twice the length of the dorsal plate; bred from wheat heads........tritici Kirby

cc Stems of the 5th antennal segment plainly unequal

d Stems each with a length 3 and 4½ times its diameter

e Abdomen reddish yellow, length 1.5 mm; bred from flowers of Apocynum ....apocyni n. sp., C. a1684a

ee Abdomen greenish bronze, length 1.5 mm; bred from flowers of Spiraea......................spiraeaflorae Felt, a1681b

dd Stems each with a length 1½ and 2½ times its diameter

e Abdomen dark or reddish brown, length 2 mm .... hudsoni Felt, C. 1

ee Abdomen reddish yellow, length 1.5 mm .... setariae Felt, a1721

bbb Ventral plate truncate or nearly so

c Abdomen pale yellowish orange, length 1.6 mm; 5th antennal segment having the stems equal, each with a length ½ greater than its diameter..............................nixoni n. sp., C. 510

cc Abdomen dark fuscous yellowish, length 1.25 mm; 5th antennal segment having the stems with length 2½ and 3 times their diameters ....tolhurstae n. sp., C. 721

bbbb Ventral plate broadly rounded, dorsal plate long, the lobes rounded

c Abdomen pale orange, with a fuscous spot basally, length .5 mm; 5th antennal segment having the stems with a length 2¼ and 3 times their diameters...........................quercina Felt, C. 3.2

aa Ventral plate short

b Ventral plate broad, deeply and roundly emarginate

c Abdomen pale yellowish, length 1.25 mm; dorsal plate short; triangularly emarginate, the lobes produced laterally, the 5th antennal segment having the stems equal, each with a length 3½ times its diameter; bred from rolled leaves of Verbena urtifolia .... urtifolia n. sp., C. a1577

cc Abdomen pale yellowish, length 1.5 mm, dorsal plate short, triangularly emarginate, the lobes angularly rounded, the 5th antennal segment having the stems each 3½ times its diameter. Bred from dwarfed catalpa shoots.................catalpae Comst., a1804

ccc Abdomen pale yellowish, length 2 mm; dorsal plate short, angularly and slightly emarginate; 5th antennal segment having the stems with a length ½ and 2½ times their diameters.................... tecomiae Felt, C. a1260

cccc Abdomen light yellowish brown, length 2 mm; 5th antennal segment having the stems with a length 1½ times their diameters.......... resinicola O. S., C. a185

bb Ventral plate broadly and roundly emarginate

c Ventral plate tapering distally

d Fifth antennal segment having the basal portion of the stem with a length less than its diameter

e Abdomen reddish brown, length 1 mm; 5th antennal segment having the stems with a length ½ and 1½ that of the diameter antennata n. sp., C. 69

ee Abdomen dark brown, length .75 mm; 5th antennal segment having the stems with a length ¼ and 1½ that of the diameter flavoscuta Felt, C. 76

eee Abdomen dark reddish, length 1 mm; 5th antennal segment having the stems with a length ¾ and twice that of the diameter foliora Rssl. & Hkr., C. 1339

dd Fifth antennal segment having the basal portion of the stem with a length greater than its diameter

e Abdomen reddish brown, length 1.6 mm; 5th antennal segment having the stems with a length 1½ and 2½ times that of the diameters........................claytoniae Felt, C. 46

cc Ventral plate hardly tapering distally, very short and broad

d Abdomen pale yellowish, length .75 mm; 5th antennal segment having the stems with a length 2 and 2½ times that of the diameters.......................excavationis Felt, C. 65

EPIDOSARIAE

This group contains a number of very characteristic forms which nevertheless present many structural diversities. The members of the group may be best recognized by the well defined cross vein uniting subcosta with the base of the third vein. This cross vein frequently has a course nearly parallel with costa, though in certain forms it diverges from the third vein at an oblique angle, and in some species almost at a right angle. The third vein unites with the margin of the wing beyond the apex. Several genera are undoubtedly represented in our American fauna which have not been differentiated from the older established ones. So little is known of the life history of these species and there is such great diversity between the two sexes, that the present studies must be regarded as preliminary.

Key to genera

a Three long veins

b Cross vein not parallel with costa

c 5th vein forked, the wings very long and narrow, the legs long... Colpodia Winn.

cc 5th vein simple, wings broader and legs shorter.................. (type J. rubra) Johnsonomyia n. g.

bb Cross vein running parallel or nearly so to costa

c 5th vein forked

d Antennae greatly prolonged in both sexes.................. Porricondyla Rond.

dd Antennae not greatly prolonged in both sexes..Dirhiza Winn.

cc 5th vein simple..............................Holoneurus Kieff.

aa 4 long veins, the 5th simple

b Cross vein running parallel or nearly so to costa..Asynapta H. Lw.

bb Cross vein running at a considerable angle with costa................ Winnertzia Rond.

COLPODIA Winn.

This genus is remarkable for the extremely long, slender wings, the fifth vein being forked and the cross vein almost at right angles to costa [pl. 39, fig. 1]. The legs are very long and slender. The genitalia are peculiar, *see* plate 43.

Key to species

a 12 antennal segments; females

b Abdomen reddish brown, length 1 mm; wings very slender, with a length about 5 times the width.................................... (Porricondyla) graminis Felt, C. 570

bb Abdomen reddish yellow, length 2 mm; wings rather broad, with a length about 4 times the width...temeritatis n. sp., C. a1546b

aa 13 antennal segments; females

b 5th antennal segment with a stem 1/4 the length of the basal enlargement

c Abdomen carmine, length 1.5 mm, the basal enlargement of the 5th antennal segment with a length 6 times its diameter, the 4th palpal segment with a length 4 times its diameter.......... sanguinia n. sp., C. 1227

cc Abdomen yellowish brown, length 1.6 mm, the 5th antennal segment with a length 5 times its diameter, the 4th palpal segment with a length 5 times its diameter...................... terrena n. sp., C. 525

ccc Abdomen yellowish orange, length 3 mm, the basal enlargement of the 5th antennal segment with a length 5 times its diameter, the 4th palpal segment with a length 7 times its diameter...... alta n. sp., C. 481

cccc Abdomen yellowish brown, length 1 mm, the basal enlargement of the 5th antennal segment with a length 4 times its diameter, the 4th palpal segment with a length 5 times its diameter; bred from Poa pratensis.................... pratensis n. sp., C. 256

aaa 16 antennal segments

b 5th antennal segment with a stem 1/3 the length of the basal enlargement

c Abdomen pale orange, length 2 mm, the basal enlargement of the 5th antennal segment with a length 3 times its diameter......... maculata n. sp., C. 560

bb 5th antennal segments with a stem 1/4 longer than the basal enlargement

c Abdomen pale yellowish, length 1.5 mm, the basal enlargement of the 5th antennal segment with a length 2½ times its diameter longimana, n. sp., C. 830

bbb 5th antennal segment with a stem 1½ times the length of the basal enlargement

c Abdomen pale salmon, length 2 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter....... (Porricondyla) pinea Felt, C. a1622

bbbb 5th antennal segment with a stem twice the length of the basal enlargement

c Abdomen dark brown, length .75 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter...... (Porricondyla) trifolii Felt, C. 455

bbbbb 5th antennal segment with a stem 2½ times the length of the basal enlargement

c Abdomen pale yellowish, length 1 mm, the basal enlargement of the 5th antennal segment with a length 3 times its diameter... (Porricondyla) diervillae Felt, C. 485

cc Abdomen fuscous yellowish, length 1.3 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter.... (Porricondyla) carolinae Felt, C. a1624

ccc Abdomen pale yellowish, length 1.75 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter.... pectinata Felt, C. a1599

JOHNSONOMYIA n. g.

This genus is erected for several small forms apparently closely allied to Colpodia Winn., in that the wings are long, narrow, and the cross vein not parallel with costa. Members of this genus may be recognized by the simple unbranched fifth vein and also by the somewhat broader wings and shorter legs than obtain in Colpodia. It is distinguished at once from Bryocrypta Kieff. by the simple fifth vein [pl. 39, fig. 4].

Type J. rubra.

Key to species

a 12 antennal segments, the 5th with a stem ⅓ the length of the basal enlargement

b Abdomen pale orange, length 1 mm; female..humilis n. sp., C. 658

aa 16 antennal segments, the 5th with a stem at least as long as the basal enlargement; males

b Abdomen dark brown and yellowish, length 4 mm, the 5th antennal segment with a stem as long as the basal enlargement............. fusca n. sp., C. 1237

bb Abdomen reddish brown, length 4 mm, the 5th antennal segment with a stem ½ longer than the basal enlargement..rubra n. sp., C. 826

PORRICONDYLA Rond.

This genus may be recognized by the cross vein being parallel or nearly so with costa, and the fifth vein forked, in connection with the greatly produced antennal segments of both sexes. *See* plate 39, figures 2, 5 and 8 for wing characters. The genitalia are variable and in some species very striking [*see* pl. 44].

Key to species

a 12 antennal segments, the 5th with a stem ¼ the length of the basal enlargement; female

b Abdomen dark brown, length 1.5 mm, the 4th palpal segment 1¾ longer than the 3d, the terminal lobe of the ovipositor oval and with a length twice its width............q u e r c i n a Felt, C. 62

aa 13 antennal segments, the 5th with a stem ¼ the length of the basal enlargement; females

b Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the 5th antennal segment with a length 3½ times its diameter; terminal lobes of the ovipositor narrowly oval, with a length 3½ times the width....................t u c k e r i n. sp., C. 1255

bb Abdomen reddish yellow, length 2.5 mm, the basal enlargement of the 5th antennal segment with a length 4 times its diameter, the terminal lobe of the ovipositor tapering, with a length fully 4 times its width........................c a u d a t a n. sp., C. 531

aaa 14 antennal segments

b 5th antennal segment with a stem ¼ or ⅓ the length of the basal enlargement; females

c Abdomen brown, the dorsal sclerites heavily chitinized anteriorly and posteriorly, length 1.5 mm....k a r n e r e n s i s Felt, C. 30

cc Abdomen dark reddish brown, the dorsal sclerites evenly chitinized, length 1.5 mm..................c a r o l i n a, C. a1625

bb 5th antennal segment with a stem ½ the length of the basal enlargement

c Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the 5th antennal segment with a length 3½ times its diameter, 4th palpal segment ⅓ longer than the 3d..b o r e a l i s Felt, C. 155

aaaa 16 antennal segments; males

b 5th antennal segment with a stem as long as the basal enlargement

c Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter.... c a n a d e n s i s n. sp., C. 1334

bb 5th antennal segment with a stem ½ longer than the basal enlargement

c Abdomen dark brown, length 1.5 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter; terminal clasp segment greatly enlarged apically................ p i n i Felt, C. 221

cc Abdomen orange yellow, length 1.5, the basal enlargement of the 5th antennal segment with a length 1¾ its diameter; terminal clasp segment greatly swollen basally.................. d i l a t a t a n. sp., C. a1149

bbb 5th antennal segment with a stem twice the length of the basal enlargement

c Abdomen light yellowish brown, length 2 mm, the basal enlargement of the 5th antennal segment with a length 2½ times its diameter.............................b a r b e r i n. sp., C. 948

bbbb 5th antennal segment with a stem 2½ times the length of the basal enlargement

c Abdomen fuscous yellowish, length 3 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter; terminal clasp segment enlarged apically......................
hamata Felt, C. a1626

cc Abdomen light yellowish, length 1 mm, the basal enlargement of the 5th antennal segment with a length twice its diameter, the terminal clasp segment not greatly enlarged apically.........
flava Felt, C. 151

aaaca 20 antennal segments, the 5th with a stem 2½ times as long as the basal enlargement; males

b Abdomen fuscous yellowish, length 2.5 mm, the basal enlargement of the 5th antennal segment with a length ¼ greater than its diameter........................multinoda n. sp., C. 789

DIRHIZA Winn.

This genus may be separated from Porricondyla Rond. by

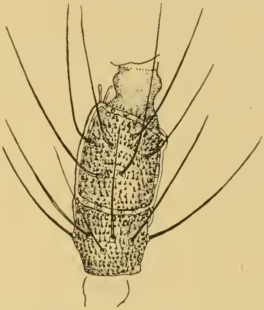


Fig. 47 Dirhiza hamata Felt, 6th antennal segment of female, much enlarged. (Original)

the antennae not being greatly prolonged in both sexes. The wing is illustrated on plate 39, figure 7.

Key to species

a 12 antennal segments

b 5th antennal segment with a stem ⅓ the length of the basal enlargement

c Abdomen yellowish, length 1 mm; female........................
(Porricondyla) sylvestris Felt, C. 175

aa 13 antennal segments

b 5th antennal segment with a stem ¼ the length of the basal enlargement

c Abdomen dark brown, length 2.5 mm; female..................
hamata Felt, C. 142

aaa 16 antennal segments

b 5th antennal segment with a stem ¼ the length of the basal enlargement

c Abdomen yellowish, length 3 mm; female ....
photophila n. sp., C. 45

aaaa 20 or more antennal segments

b Abdomen yellowish orange, length 3 mm; 24 antennal segments, the 5th with a stem ¼ the length of the basal enlargement, which latter has a length 3 times its diameter; the 4th palpal segment ¼ longer than the 3d..................canadensis n. sp., C. 952

bb Abdomen light reddish brown, length 3 mm; 25 antennal segments, the 5th with a stem ¼ the length of the basal enlargement, which latter has a length 2½ times its diameter; 3d and 4th palpal segments nearly equal................montana n. sp., C. 953

bbb Abdomen pale yellowish, length 2 mm; 26 antennal segments, the 5th with a stem ⅓ the length of the basal enlargement; the 4th palpal segment ½ longer than the 3d ....
multiarticulata n. sp., C. 831

HOLONEURUS Kieff.

This genus may be separated from Porricondyla and Dirhiza by the fifth vein being simple [pl. 39, fig. 3] and the four palpal segments distinguish it from Colomyia Kieff.

Key to species

a 12 antennal segments, the stem of the 5th as long as the basal enlargement

b Abdomen yellowish, length 1.25 mm; female ....
(Porricondyla) altifilus Felt, C. 398

aa 16 antennal segments, the 5th with a stem twice the length of the basal enlargement

b Abdomen yellowish brown, length 2 mm; male ....
elongatus n. sp., C. 954

aaa 25 antennal segments, the 5th with a stem ¼ longer than the basal enlargement

b Abdomen dull yellowish, length 3 mm; male.........................
multinodus n. sp., C. 528

ASYNAPTA H. Lw.

This genus may be recognized by the four long, simple veins, the fifth being simple, and by the cross vein being parallel or nearly so with costa [pl. 39, fig. 6].

Key to species

a 16 antennal segments, the 5th with a stem ½ longer than the basal enlargement

b Abdomen yellowish brown, length 2 mm, the basal enlargement of the 5th antennal segment with a length 3 times its diameter; the terminal clasp segment broadly triangular.........................
(Winnertzia) furcata Felt, C. 336

aa 18 antennal segments, the 5th with a stem ¾ the length of the basal enlargement

b Abdomen light yellow, length 2 mm, the basal enlargement of the 5th antennal segment with a length ¾ greater than its diameter... f l a v i d a n. sp., C. 504

aaa 19 antennal segments

b 5th antennal segment with the stem in the male ¾ and in the female ⅕ the length of the basal enlargement

c Abdomen reddish orange, length male 2 mm, female 1.5 mm, the basal enlargement of the 5th antennal segment with a stem twice the diameter; bred from R h a b d o p h a g a b a t a t a s galls........................s a l i c i p e r d a n. sp., C. a1815a

aaaa 20 or more antennal segments

b 5th antennal segment with a stem as long as the basal enlargement

c Abdomen reddish brown, length 2 mm; 21 antennal segments, the basal enlargement of the 5th with a length ½ greater than its diameter.......................c a u d a t a n. sp., C. 1219

cc Abdomen orange-yellow, length 1.5 mm; 23 antennal segments, the basal enlargement of the 5th with a length ¾ greater than its diameter........................c e r a s i Felt, C. 236

ccc Abdomen light brown, length 1.5 mm; 23 antennal segments, the basal enlargement of the 5th with a length twice its diameter.... c a n a d e n s i s n. sp., C. 1335

bb 5th antennal segment with a stem ¼ longer than the basal enlargement

c Abdomen reddish brown, length 2 mm; 28 antennal segments, the basal enlargement of the 5th with a length twice its diameter p h o t o p h i l a Felt, C. 119

WINNERTZIA Rond.

This genus is easily distinguished from all other members of the group by the four simple long veins, and in particular by the cross vein arising from the third vein at an obtuse angle [pl. 39, fig. 9]. The antennal structures are exceedingly peculiar, inasmuch as the circumfili are modified to form unique horseshoelike structures on each side of the antennal segments.

Key to species

a 13 antennal segments, the 5th with a stem ¾ the length of the basal enlargement

b Abdomen yellowish brown, length 1 mm; male .... c a r p i n i Felt, C. 106

aa 14 antennal segments

b Segments sessile or subsessile; females

c Abdomen reddish brown, length 2 mm, the 5th antennal segment with a length ½ greater than its diameter, the 4th palpal segment ½ longer than the 3d.....a r i z o n i e n s i s n. sp., C. 1022

cc Abdomen greenish yellow, length 2 mm, the 5th antennal segment with a length 3 times its diameter, the 4th palpal segment twice the length of the 3d.........c a l c i e q u i n a Felt, C. 673

ccc Abdomen pale straw, length 2 mm, 5th antennal segment with a length twice its diameter, the 4th palpal segment ½ longer than the 3d....................k a r n e r e n s i s n. sp., C. 395

cccc Abdomen fuscous yellowish, length 1.5 mm, 5th antennal segment with a length 2½ times its diameter, the 4th palpal segment twice as long as the 3d..........h u d s o n i c i n. sp., C. a1555y

bb 5th antennal segment with a stem ⅓ the length of the basal enlargement; males

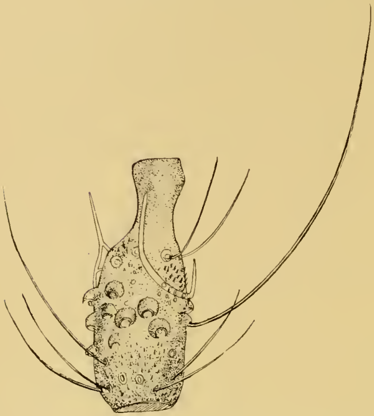


Fig. 48 W i n n e r t z i a a m p e l o p h i l a Felt, 6th antennal segment of male, much enlarged. (Original)

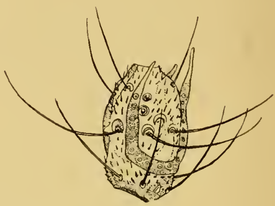


Fig. 49 W i n n e r t i z a c a l c i e q u i n a Felt, 11th antennal segment of female, much enlarged. (Original)

c Abdomen dark yellowish brown, length 1.5 mm, the 4th palpal segment twice the length of the 3d..........................
(P o r r i c o n d y l a) a m p e l o p h i l a Felt, C. 450

cc Abdomen dark brown, length .75 mm, 4th palpal segment twice the length of the 3d..............s o l i d a g i n i s Felt, C. 508

bbb 5th antennal segment with a stem ¾ the length of the basal enlargement; males

c Abdomen yellowish green basally, apically light brown, length 2 mm; 4th palpal segment ½ longer than the 3d..............
c a l c i e q u i n a Felt, C. 561

cc Abdomen dull brown, length 1.25 mm; 4th palpal segment ¼ longer than the 3d..........................r u b i d a, C. 300

bbbb 5th antennal segment with a stem as long as the basal enlargement; male

c Abdomen dark brown, length 1 mm; 4th palpal segment twice the length of the 3d............p i n i c o r t i c i s Felt, C. 1047

EXPLANATION OF PLATES

PLATE 1

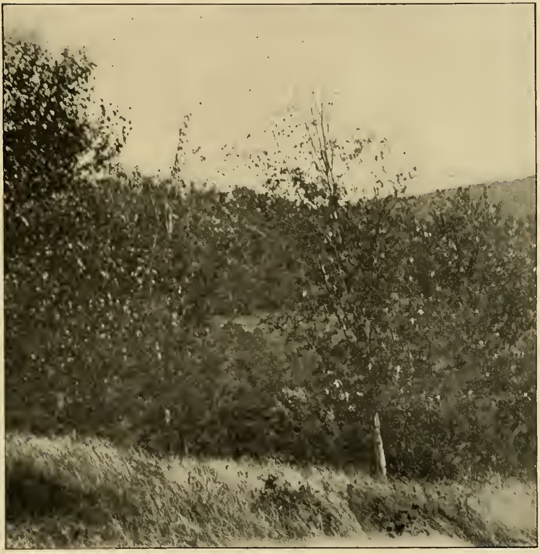
1 Snow-white linden moth, Ennomos subsignarius Hübn.
2 Work of striped maple worm, Anisota rubicunda Fabr.

PLATE 2

1 Leucobrephos brephoides Walk.
2 Work of apple leaf folder, Ancylus nubeculana Clem.

Plate 1

1 Snow-white linden moth



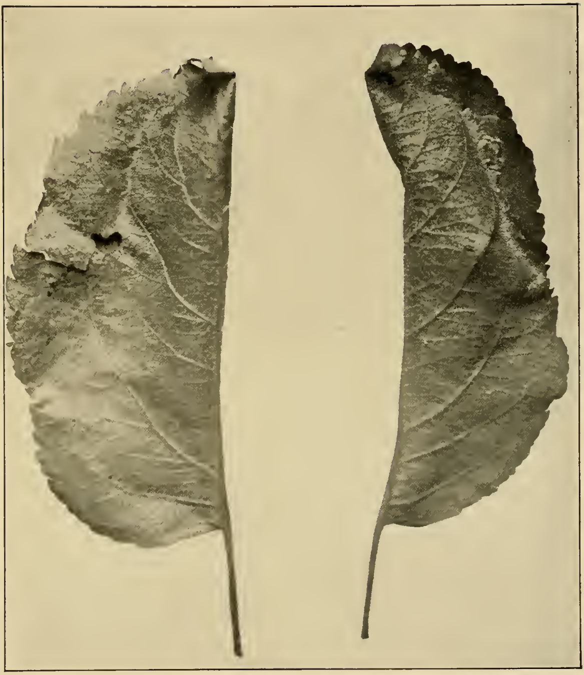
2 Work of striped maple worm

PLATE 3

Eriophyes gall (no. 82) on Nyssa

Plate 2

1 Lenco brephos brephoides



2 Work of apple leaf folder, Ancylus nubeculana

PLATE 4

Old Forge hatchery and Moose river

Plate 3

Eriophyes gall (no. 82) on Nyssa

PLATE 5

Old Forge pond as seen from the village

432

Plate 4

Old Forge hatchery and Moose river

PLATE 6

Bald Mountain pond at its lower end

434

Plate 5

Old Forge pond

PLATE 7

Beaver Meadow brook above the fish ponds

436

Plate 6

Bald Mountain pond

PLATE 8

437

Water tent trap in Beaver Meadow brook

Plate 7

Beaver Meadow brook

PLATE 9

1 Moss covered stone from bed of Beaver Meadow brook
2 Fresh-water sponge from cove at outlet of twin ponds

Plate 8

Water tent trap

PLATE 10

1 Wings of *Habrophlebia vibrans*
2 Abdominal appendages of the male, viewed from above
3 Abdominal appendages of the male of *Ephemerella dorothea*
4 Thoracic crest of female subimago
5 Abdominal appendages of male of *Potomanthus diaphanus*
6 Side view of end of abdomen of female, *Choroterpes betteni*, showing ovipositor
7 Side view of end of abdomen of male
8 Ventral view of male abdominal appendages

1

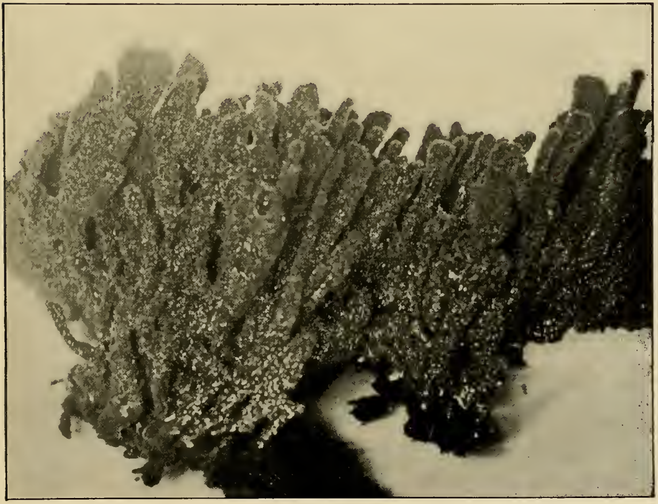


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PLATE 11

Photographs of crane fly wings

1 Dicranomyia simulans Walker
2 Phalacrocera tipulina O. S.

Plate 10

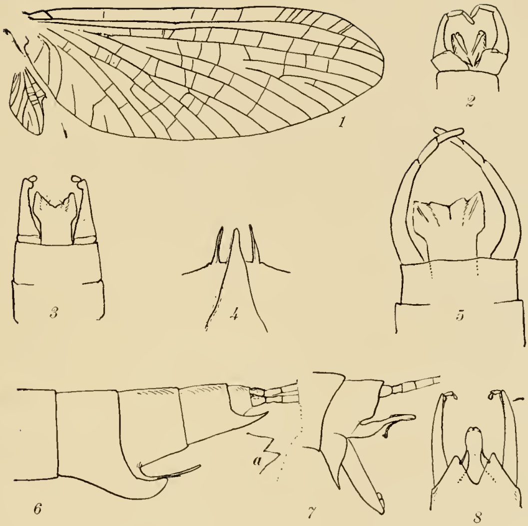
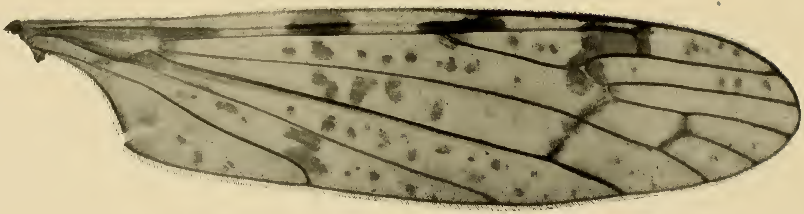


PLATE 12

1 Penthoptera albitarsis O. S.
2 Rhypholophus nubilus O. S.

446

Plate 11



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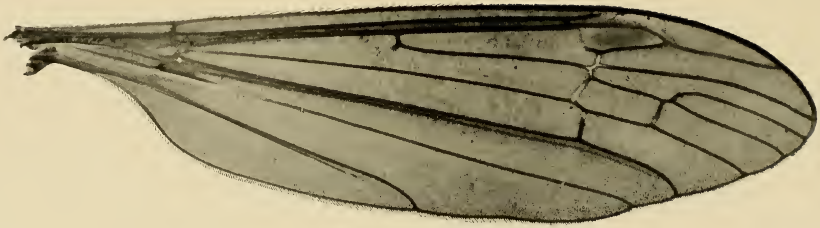

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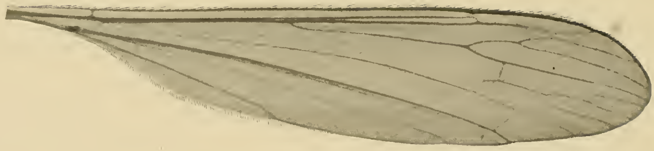
PLATE 13

1 Rhaphidolabis tenuipes O. S.
2 Limnophila montana O. S.

Plate 12

1



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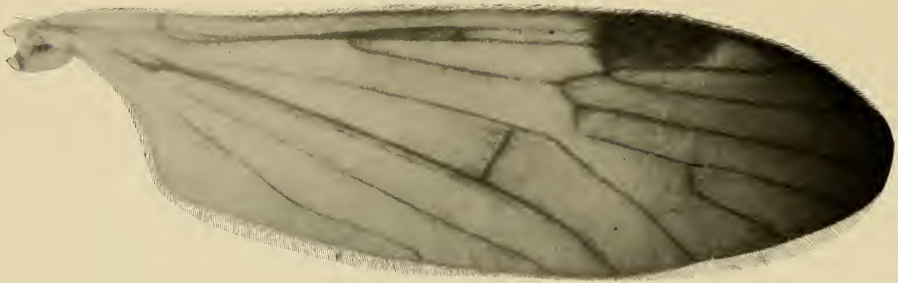
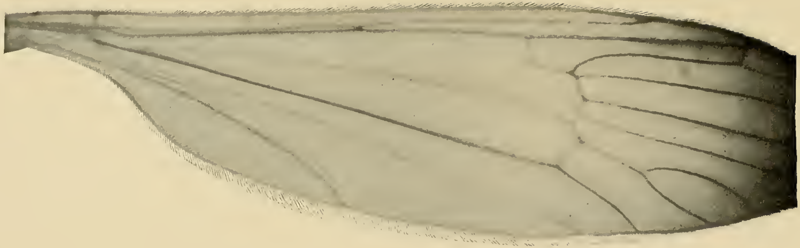


Plate 13



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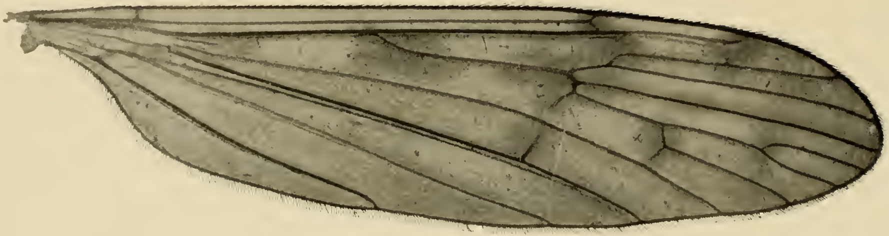

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PLATE 14

Crane fly wings

1 *Macrochile spectrum* Loew, after Loew
2 *Tanyderus pictus* Phil., after Philippi
3 *Xiphura frontalis* Loew
4 *Rhamphidia flavipes* Macq.
5 *Orimarga anomala* Mik. after Mik.
6 *Limnophila brevifurca* O. S. drawn from a photograph

Plate 14

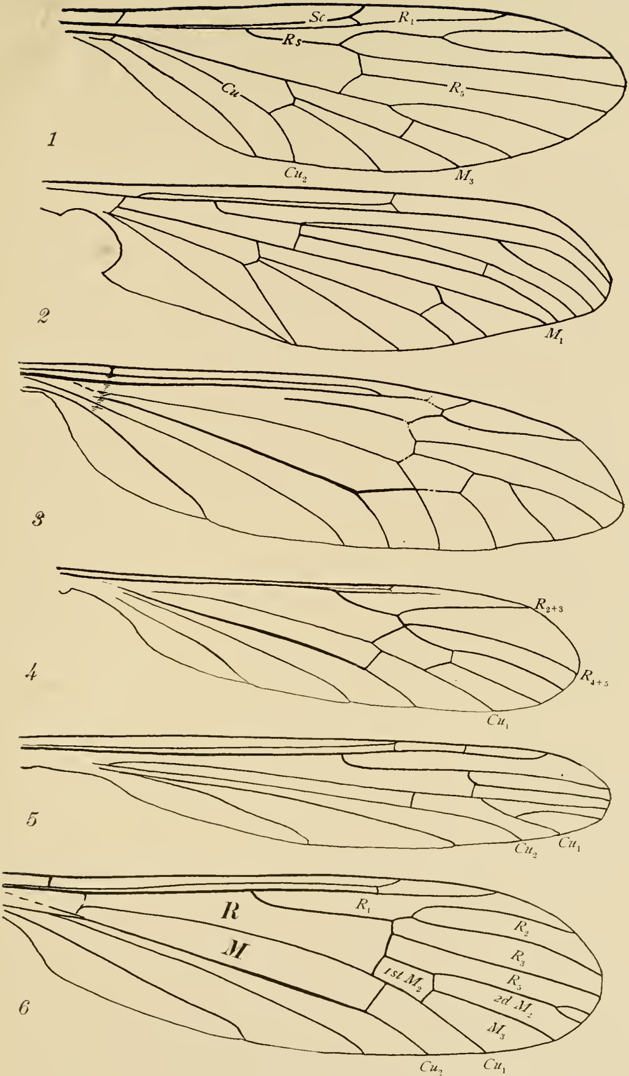

Sc
R_1
Rs
Cu
R_5
1
Cu_2
M_3
2
M_1
3
R_{2+3}
4
R_{4+5}
Cu_1
5
Cu_2
Cu_1
R
R_1
M
R_2
R_3
1st M_2
R_5
2d M_2
6
M_3
Cu_2
Cu_1

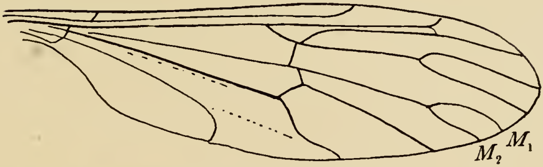
PLATE 15

Crane fly wings

1 Idioplasta fitchi O. S., after Osten Sacken
2 Ptychoptera rufocincta O. S.
3 Bittacomorpha clavipes Fabr.
4 Cylindrotoma distinctissima Meigen, after van der Wulp
5 Liogma nodicornis O. S.
6 Cyttaromyia cancellata Scudd. (fossil), after Scudder

Plate 15

1



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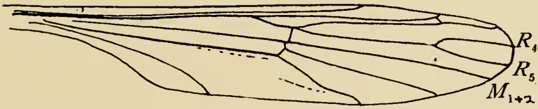

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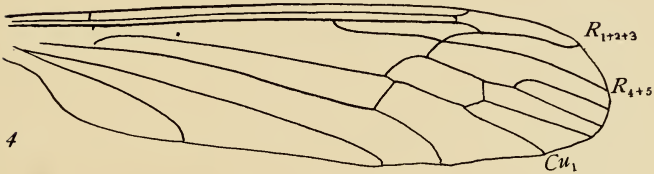

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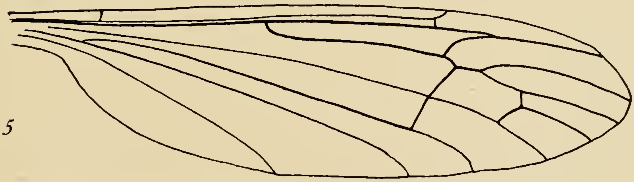

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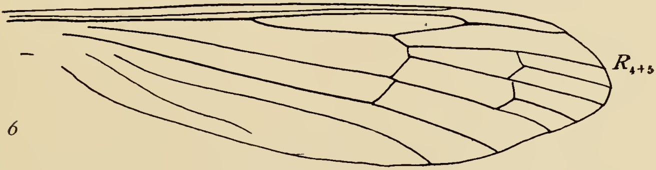

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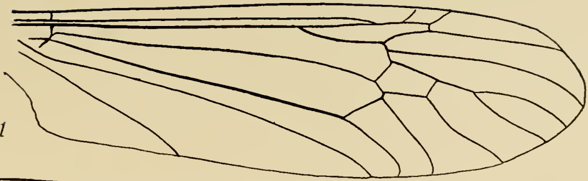
PLATE 16

Crane fly wings

1 *Ctenophora* sp.
2 ?*Tipula tenuis* v.d.W., after van der Wulp
3 *Oropeza annularis* Say
4 *Megistocera fuscana* Wulp, after van der Wulp
5 *Dolichopeza americana* Ndm.
6 *Scamboneura dotata* O. S., after Osten Sacken

Plate 16



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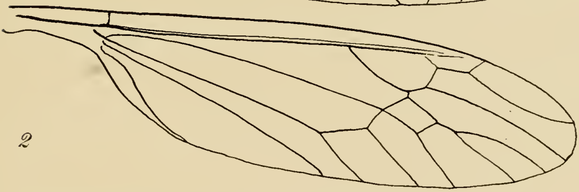

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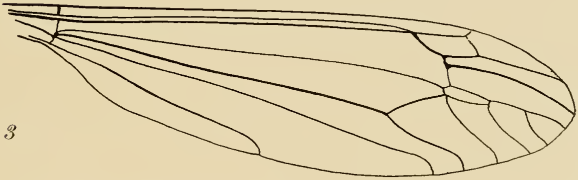

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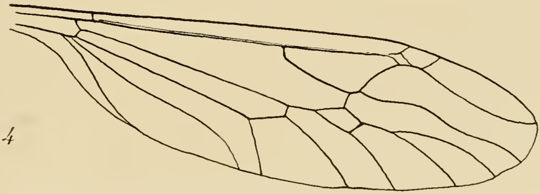

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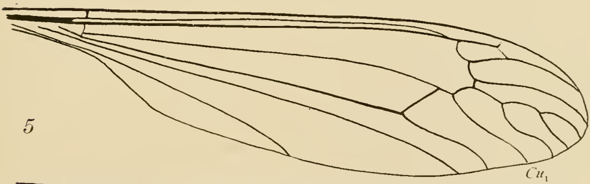

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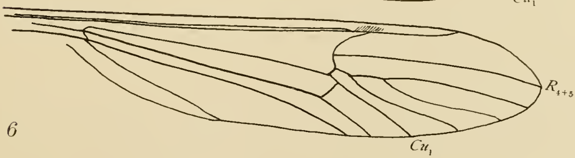

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PLATE 17

Crane fly wings

1 Undetermined Tipuline from Virginia, Ill.

2 Tip of wing of *Rhabdinobrochus extinctus* Scudd., after Scudder (Florissant fossil)

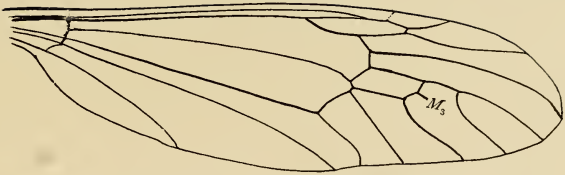
3 Tip of wing of *Plusiomyia gracilis* Walker, after Westwood

4 *Ptilogyna ramicornis* Skuse, after Skuse

5 *Semnotes ducalis* Westw., after Skuse

6 *Ozodicera griseipennis* Loew, after Loew

Plate 17



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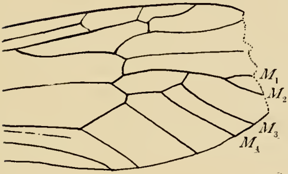

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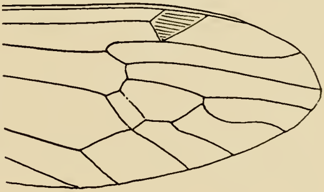

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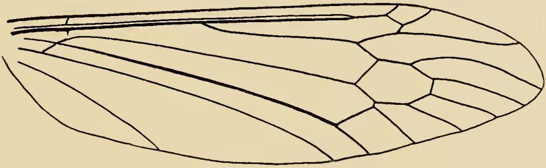

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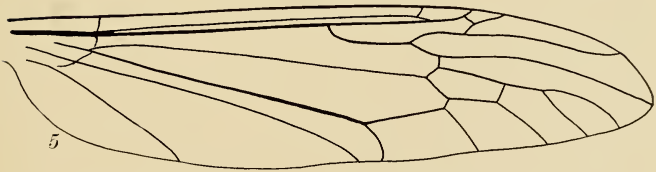

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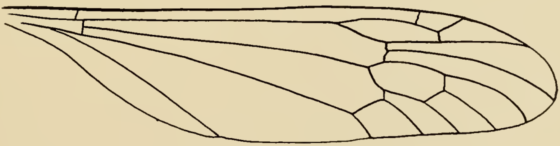

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PLATE 18

Wings of crane flies of the genus Limnophila

1 Limnophila (Dicranophragma) fuscovaria O. S.
2 Limnophila toxoneura O. S.
3 Limnophila poetica O. S.
4 Limnophila munda O. S.
5 Limnophila adusta O. S.
6 Limnophila quadrata O. S.

Plate 18

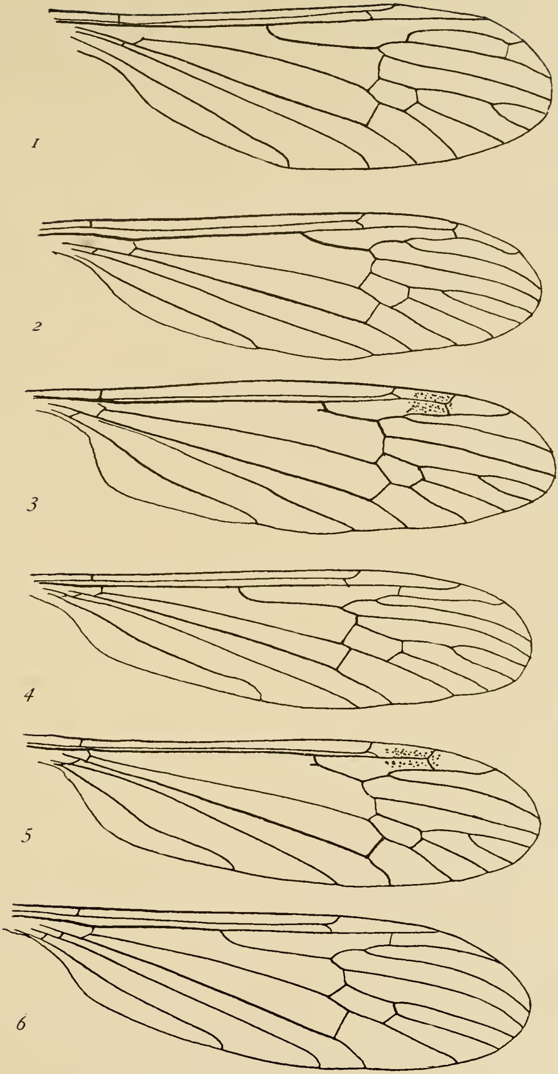


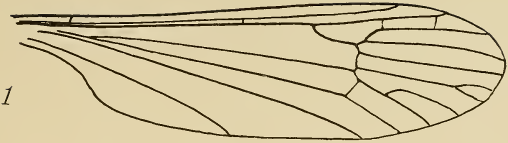
PLATE 19

459

Wings of crane flies

1 Dicranota rivularis O. S.
2 Rhaphidolabis tenuipes O. S.
3 Epiphragma fascipennis Say
4 Trichocera brumalis ? Fitch
5 Lechria singularis Skuse, after Skuse
6 Amphineurus australica Skuse, after Skuse

Plate 19



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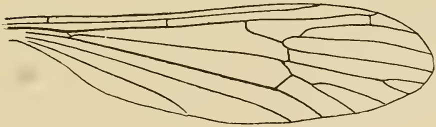

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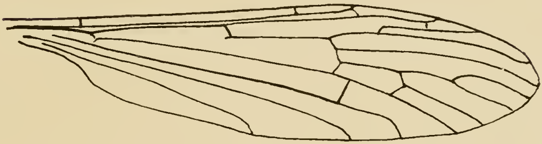

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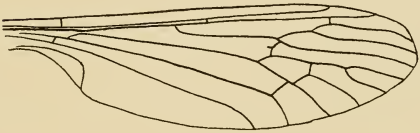

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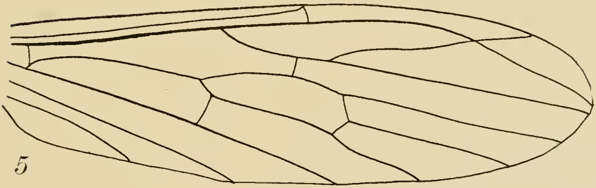

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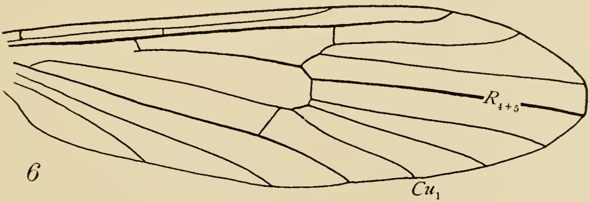

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PLATE 20

Crane fly wings

1 *Gynoplistia wakefieldi* Westw., after Westwood
2 *Eutonia barbipes* Meigen, after van der Wulp
3 *Poecilostola pallens*, after van der Wulp
4 *Palaeopoecilostola* sp.?, after Meunier
5 *Lipsothrix remota* Walk., after Wahlgren
6 *Tinemyia margaritifera* Hutt., after Hutton

Plate 20

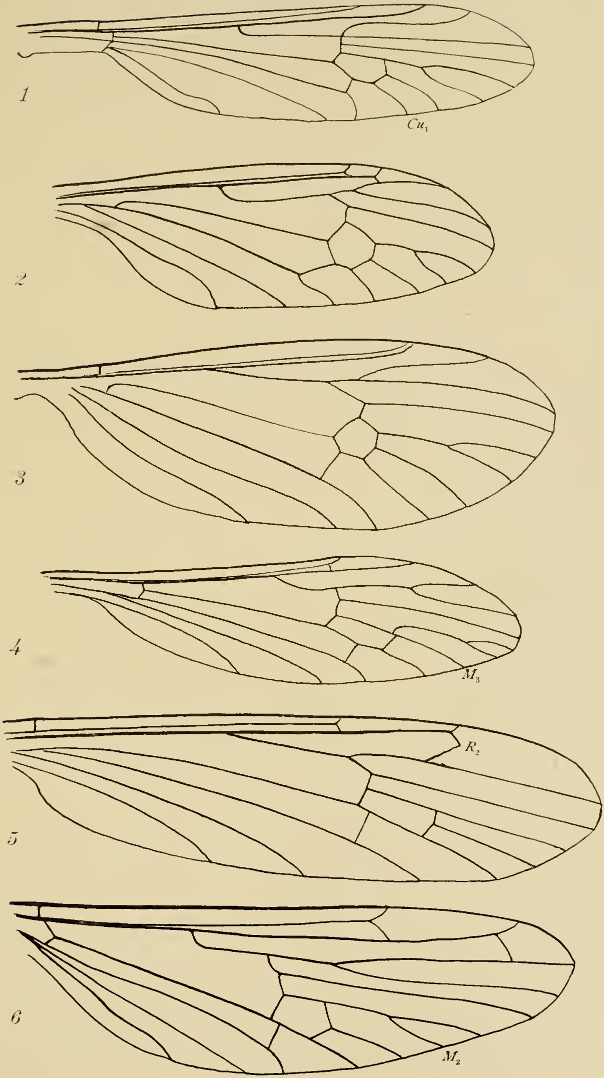


PLATE 21

Crane fly wings

1 Polymorio lutea Phil., after Philippi
2 Polymera albitarsis Will., after Williston
3 Podoneura anthracogramma Berg., after Bergroth
4 Paratropeza singularis Schin., after Schiner
5 Conosia irroratus Wied., after van der Wulp
6 Mongoma fragillima Westw., after Westwood

Plate 21

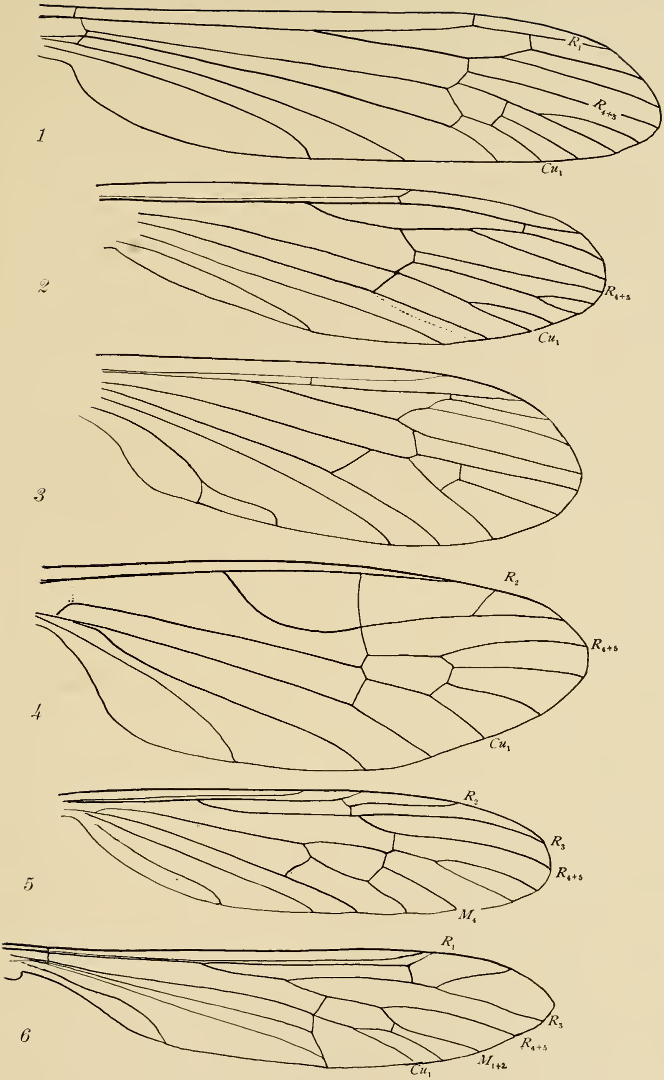
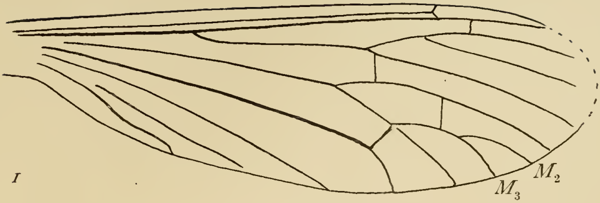

1
R_1
R_{4+5}
Cu_1
2
R_{4+5}
Cu_1
3
4
R_2
R_{4+5}
Cu_1
5
R_2
R_3
R_{4+5}
M_4
6
R_1
R_3
R_{4+5}
M_{1+2}
Cu_1

PLATE 22

Crane fly wings

1 *Cladoneura willistoni* Scudd. (fossil), after Scudder
2 *Cladura indivisa* O. S., after Osten Sacken
3 *Rhypholophus nubilus* O. S.
4 *Rhypholophus nigripilus* O. S.
5 *Rhypholophus monticola* O. S.
6 *Molophilus hirtipennis* O. S.

Plate 22



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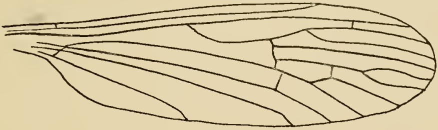
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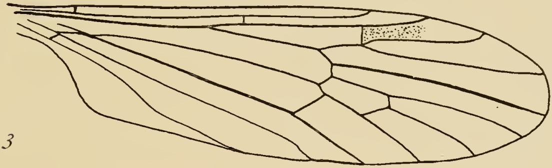
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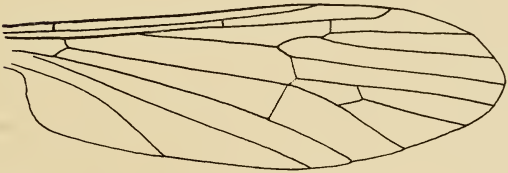
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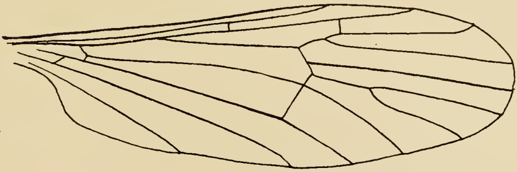
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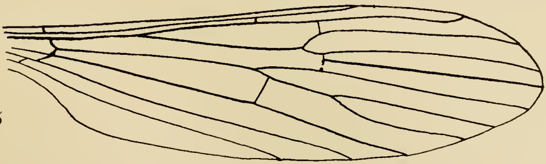
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PLATE 23

Crane fly wings

1 Erioptera villosa O. S.
2 Erioptera septemtrionis O. S.
3 E. (Mesocyphona) caloptera O. S.
4 E. (Acyphona) venusta O. S.
5 E. (Hoplolabis) armata O. S. with spur in discal cell
6 Same species with complete cross vein in discal cell

Plate 23

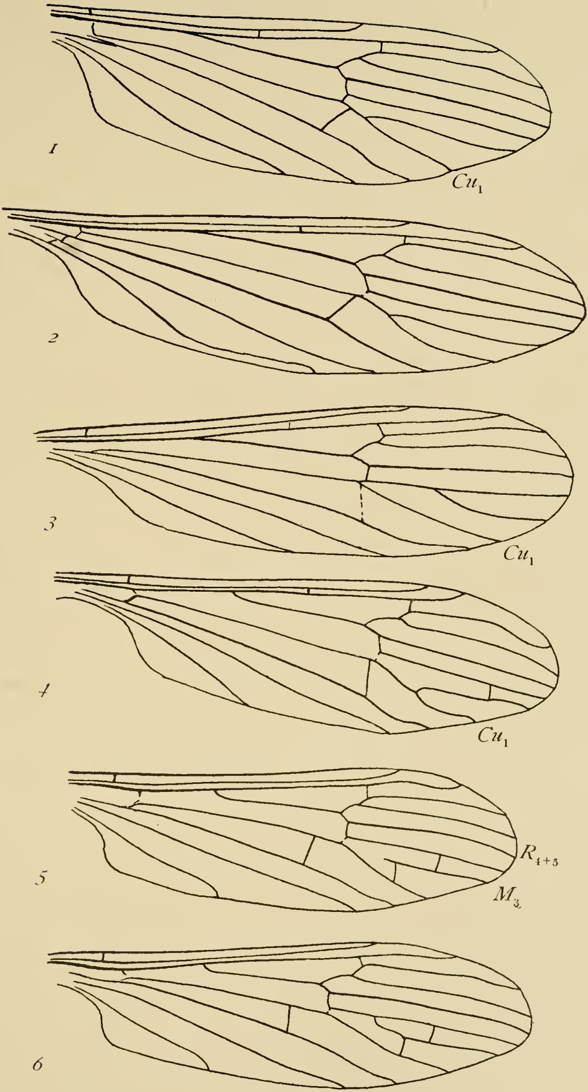


PLATE 24

Crane fly wings

1 Helobia punctipennis Meigen
2 Gonphomyia tristissima O. S.
3 Goniomyia sulphurella O. S.
4 Goniomyia cognatella O. S.
5 Goniomyia blanda O. S.
6 Mongoma manca Williston

Plate 24

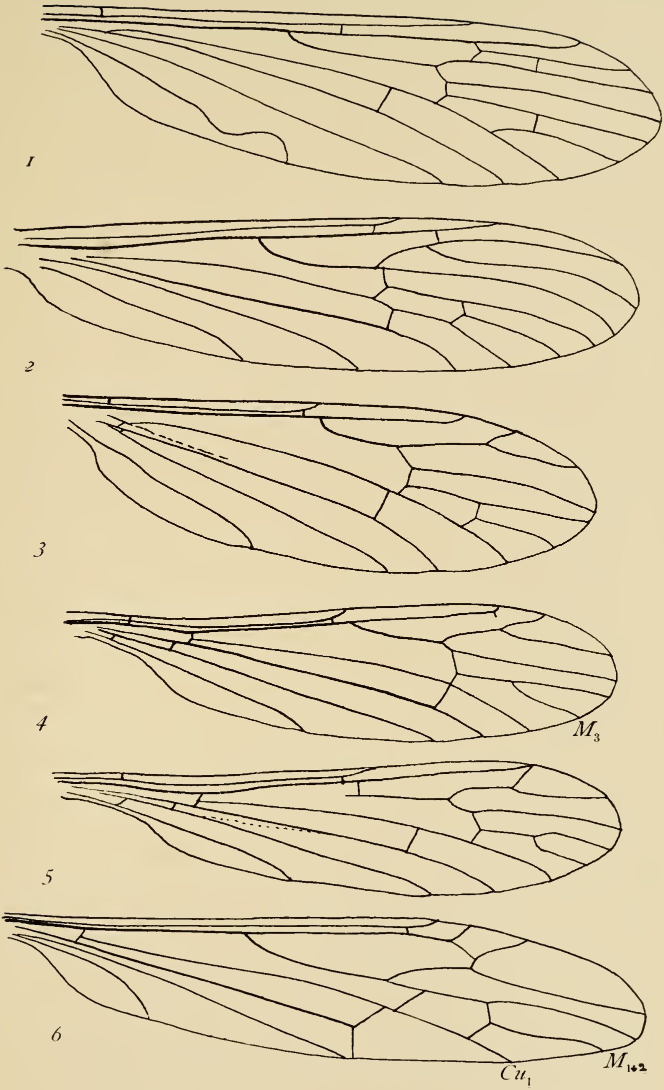


PLATE 25

Crane fly wings

1 Amalopis inconstans O. S.
2 Amalopis calcar O. S.
3 Amalopis sp. ?
4 Ula elegans O. S.
5 Ula sp. nov.
6 Polyangaeus maculatus Doane, after Doane

Plate 25

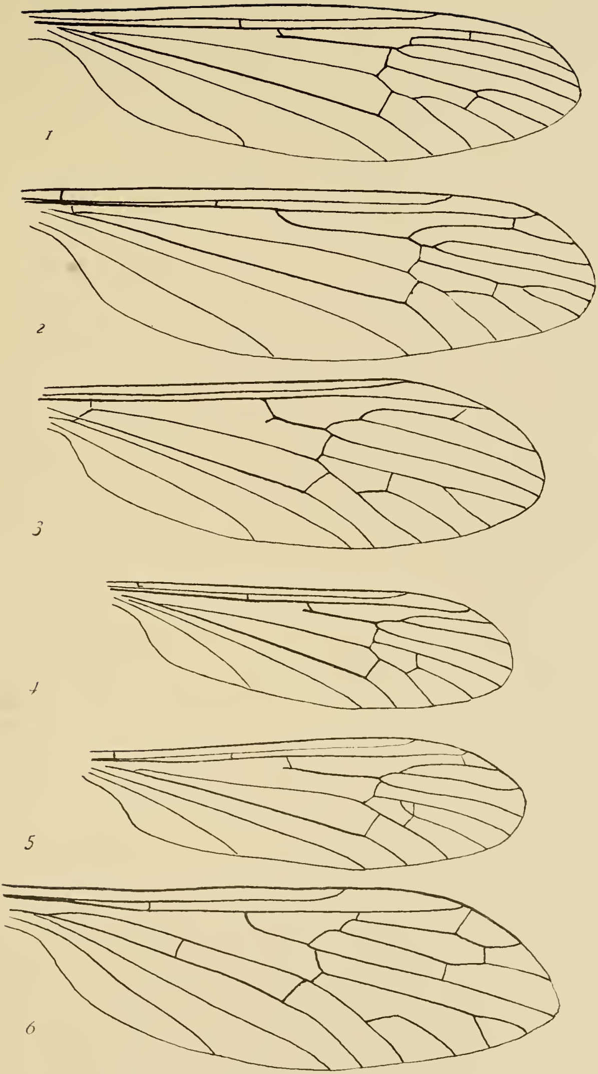
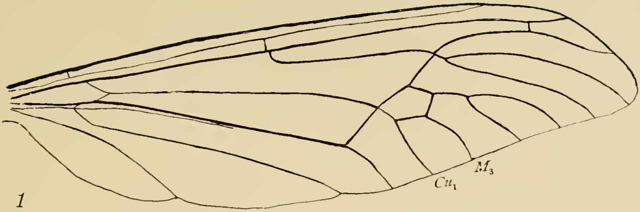


PLATE 26

Crane fly wings

1 *Pedicia albivitta* Walker
2 *Anisomera megacera* O. S.
3 *Eriocera longicornis* Walker
4 *Trimicra pilipes* Fabr., after van der Wulp, with tip of an anomalous wing he found in a specimen of the same species
5 *Phyllolabis obscurus* Doane, after Doane
6 *Styringomyia* sp., after Osten Sacken

Plate 26



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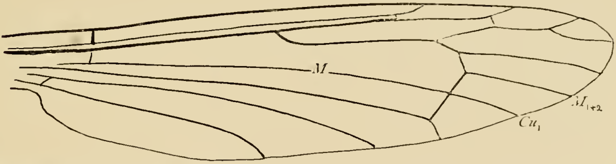

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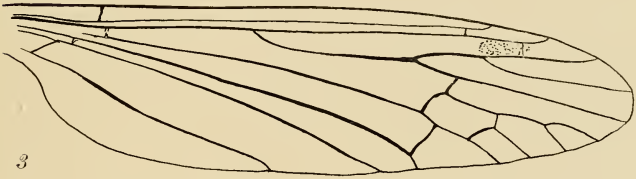

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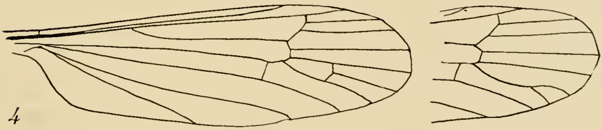

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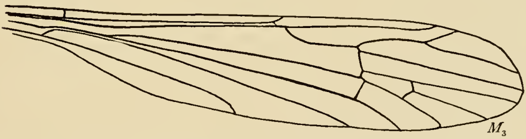

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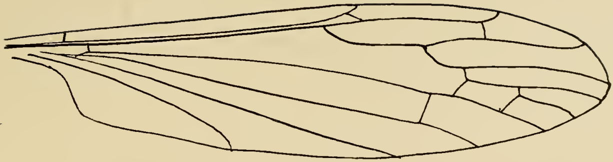
PLATE 27

Crane fly wings

1 Rhipidia maculata O. S.
2 Geranomyia canadensis O. S.
3 Dicranomyia immodesta O. S.
4 Dicranomyia cinerea Doane, after Doane
5 ? Dicranomyia whartoni Ndm.
6 Dicranoptycha germana O. S.

Plate 27



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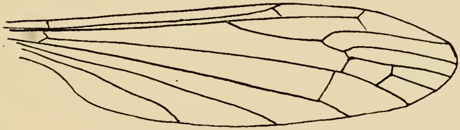

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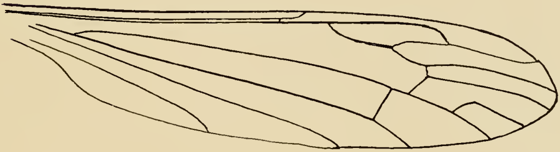

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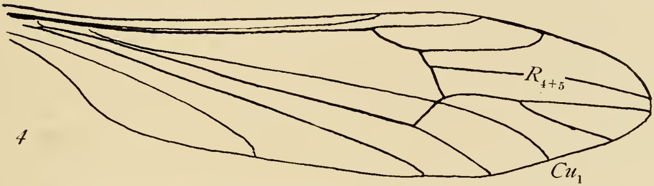

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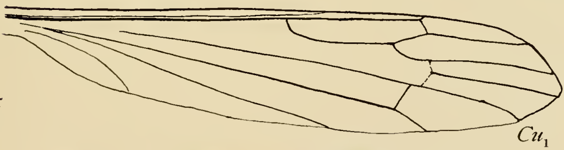

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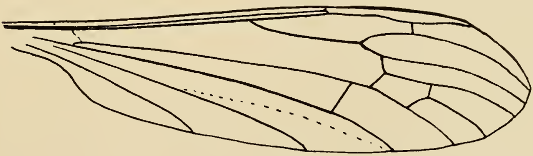

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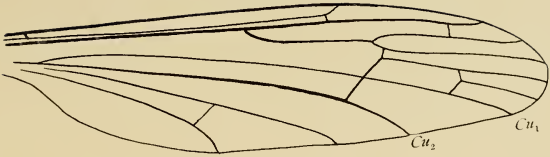
PLATE 28

Crane fly wings

1 Discobola argus Say, after Osten Sacken
2 Goniodineura nigriceps s. d. W. s., after van der Wulp
3 Dapanoptera plenipennis Walker, after Westwood
4 Peripheroptera nitens Schiner, after Schiner
5 Libnotes notata v. d. W., after van der Wulp
6 Libnotes thwaitesianana Westw., after Westwood

Plate 28



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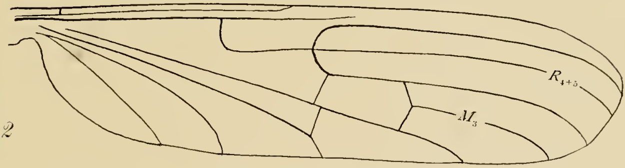

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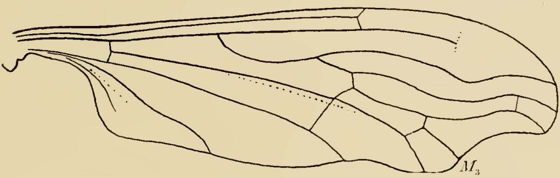

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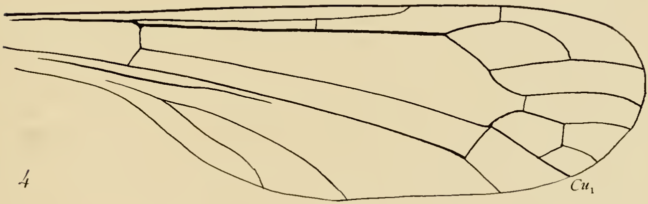

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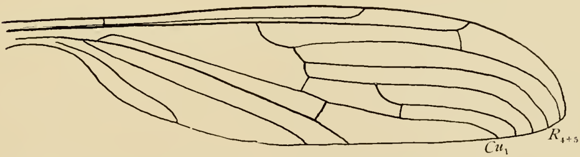

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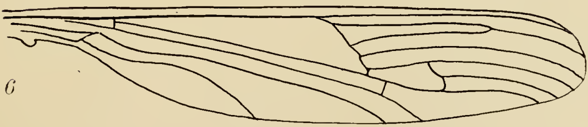

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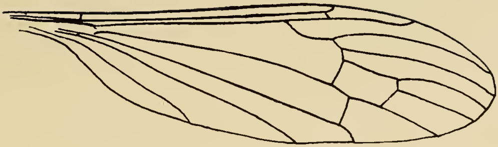
PLATE 29

Crane fly wings

1 Elephantomyia westwoodi O. S.
2 Teucholabis gracilis O. S.
3 Atarba picticornis O. S., after Osten Sacken
4 Antocha opalizans, O. S.
5 Toxorrhina muliebris O. S.
6 Diotrepha mirabilis O. S.

Plate 29



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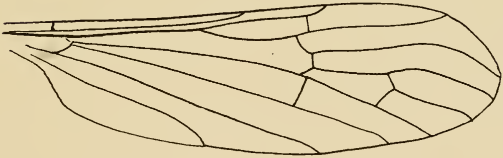

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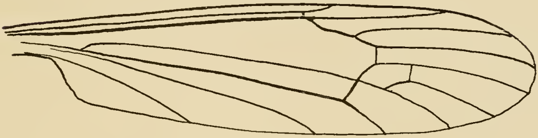

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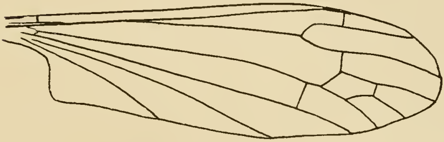

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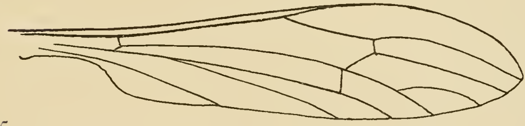

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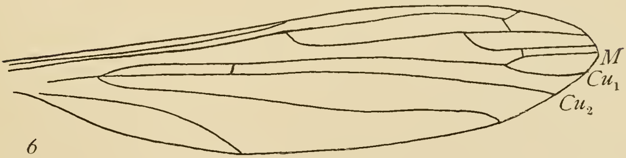

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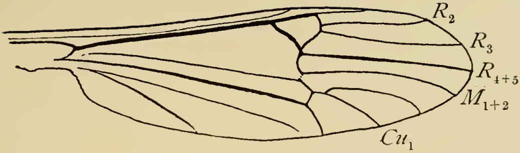
PLATE 30

Crane fly wings

1 *Cryptolabis paradox* O. S.
2 *Empeda nubila* Schum., after van der Wulp
3 *Limnobia cinctipes* Say
4 *Plectromyia modesta* O. S., after Osten Sacken
5 *Rhicnoptila wodzickii* Now., after Nowicky (degenerate)
6 *Zalusa falklandica* Enderl., after Enderlein (more degenerate)

Plate 30



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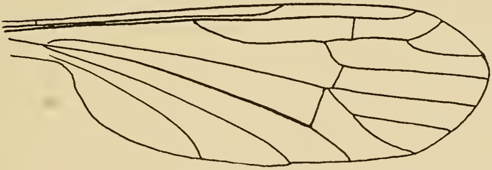

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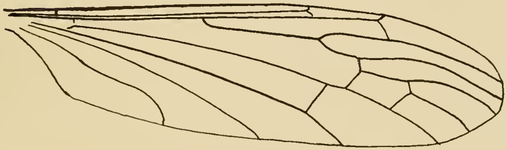

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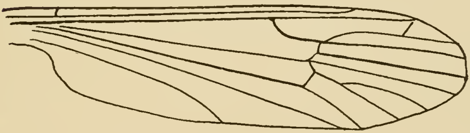

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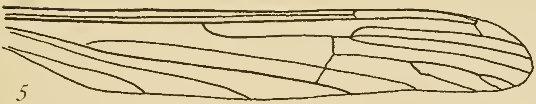

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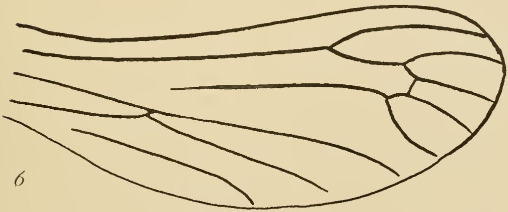

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PLATE 31

E p i p h r a g m a f a s c i p e n n i s Say, female, in attitude of flight

Crane fly (Epiphragma fascipennis)

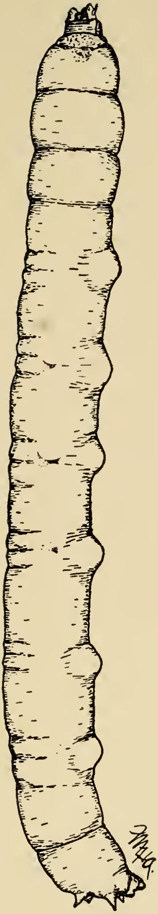
PLATE 32

Epiphragma fascipennis Say, immature stages

1 Larva, lateral view

2 End of same in dorsal view showing respiratory disk

3 Pupa



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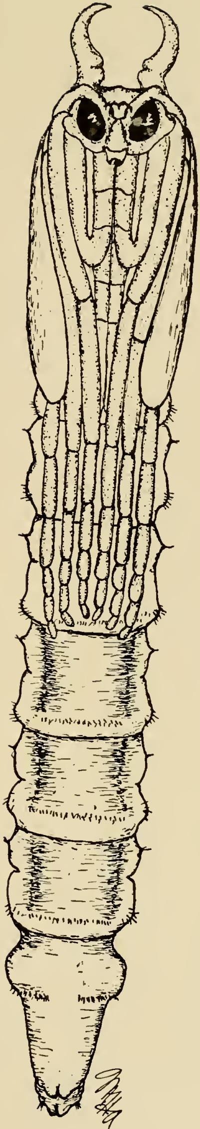


3

Larva and pupa of crane fly (Epiphragma fascipennis)

PLATE 33

1 Wing of Catocha slossonae, n. sp., C. 931, X 20
2 Wing of Lestremia sylvestris Felt, a1642, X 20
3 Wing of Microcerata perplexa, n. sp., X 20
4 Wing of Campylomyza carpini Felt, C. 107, X 20
5 Wing of Campylomyza bryanti, n. sp., C. 796, X 20
6 Wing of Brachyneura americana Felt, C. 734, X 30
7 Wing of Joanissia photophila Felt, C. 748, X 30

Plate 33

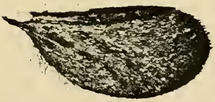

1


2


3


4


5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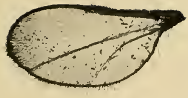
7

PLATE 34

1 Wing of *Baldratia fuscoanulata*, n. sp., C. a1550, X 20
2 Wing of *Rhopalomyia major* Felt, C. 90, X 13
3 Wing of *Trotteria tarsata*, n. sp., C. 667, X 20
4 Wing of *Lestodiplosis crataegifolia*, a1555, X 20
5 Wing of *Camptoneuromyia adhesa* Felt, a1568, X 20
6 Wing of *Rhopalomyia hirtipes* O. S., a1284, X 13
7 Wing of *Clinorhyncha millefolii* Wachtl, C. 1236, X 20
8 Wing of *Neolasioptera hibisci* Felt, a1410, X 20
9 Wing of *Diarthronomyia artemisiae*, n. sp., C. 989, X 15
10 Wing of *Rhopalomyia fusiformis* Felt, a1150, X 20

Plate 34



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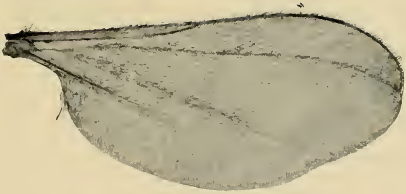

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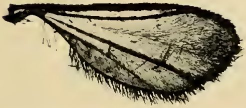

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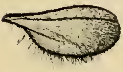

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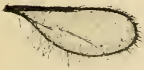

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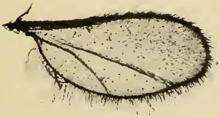

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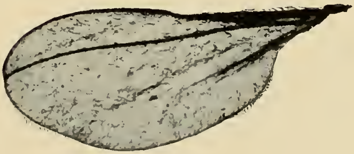

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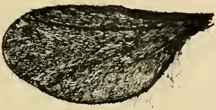
PLATE 35

1 Wing of Rhabdophaga consobrina Felt, C. 39, X 20
2 Wing of Dasyneura flavotibialis Felt, a1454, X 20
3 Wing of Dasyneura trifolii Loew, C. 742, X 20
4 Wing of Rhabdophaga populi Felt, C. 78, X 20
5 Wing of Rhabdophaga acerifolia Felt, C. 36, X 20
6 Wing of Dasyneura bidentata Felt, C. 344, X 20
7 Wing of Rhabdophaga batatas Walsh, a686, X 20
8 Wing of Dasyneura photophila Felt, C. 193, X 20

Plate 35

1



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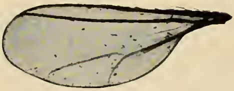

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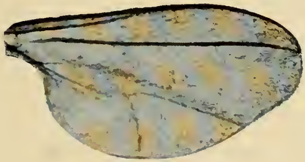

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Dasyneura and Rhabdophaga

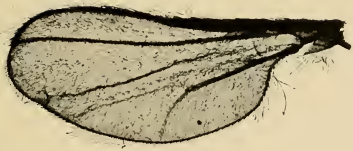
PLATE 36

1 Wing of Oligotrophus betulae Winn., C. 964, X 20
2 Wing of Sackenomyia acerifolia Felt, C. 38, X 20
3 Wing of Janetiella nodosa Felt, C. 1049, X 20
4 Wing of Janetiella asplenifolia Felt, C. 1103, X 20
5 Wing of Cincticornia transversa Felt, C. 53, X 20
6 Wing of Mayetiola thalictri Felt, C. 98, X 20
7 Wing of Schizomyia viburni n. sp., C. 1212, X 20
8 Wing of Asphondylia monacha, female O. S., C. 761, X 20
9 Wing of Asphondylia monacha, male, C. a1336, X 20

Plate 36


1


2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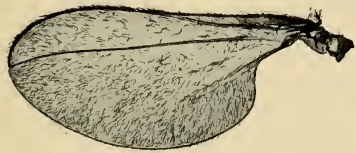
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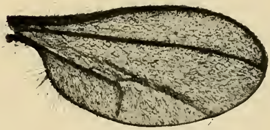
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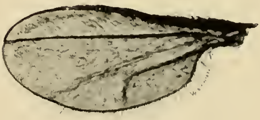
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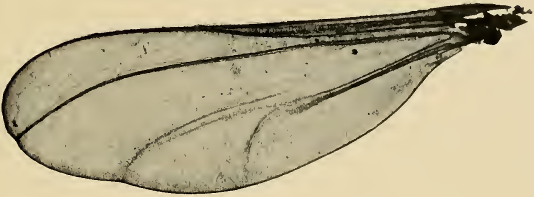
PLATE 37

1 Wing of Rhopalomyia truncata n. sp., C. 817, X 20
2 Wing of Hormomyia atlantica n. sp., C. 815, X 13
3 Wing of Bremia filicis Felt, C. 397, X 20
4 Wing of Aphidoletes hamamelidis Felt, C. 401, X 20
5 Wing of Hormomyia tubicola O. S., C. a1450, X 20
6 Wing of Contarinia pyrivora Riley, C. 790, X 20

Plate 37

1



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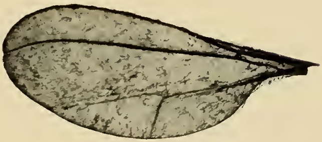

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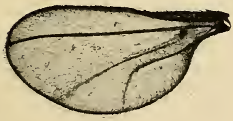

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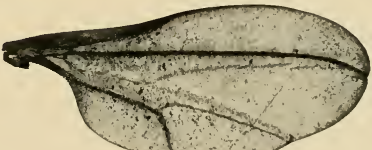

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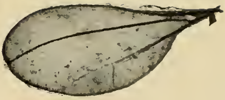
PLATE 38

1 Wing of Dentifibula caryae Felt, C. 332b, X 20
2 Wing of Giardomyia photophila Felt, C. 323, X 20
3 Wing of Lobopteromyia abdominalis n. sp., C. 16, X 20
4 Wing of Lobopteromyia tiliae Felt, C. 25, X 20
5 Wing of Mycodiplosis alternata Felt, C. 209, X 20
6 Wing of Clinodiplosis coryli Felt, C. 216, X 20
7 Wing of Karshomyia viburni Felt, C. 219, X 20
8 Wing of Lobodiplosis acerina Felt, C. 269, X 20

Plate 38


1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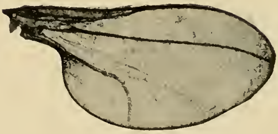
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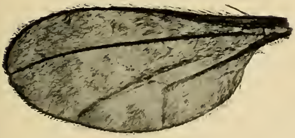
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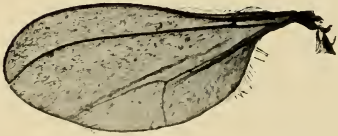
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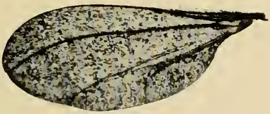
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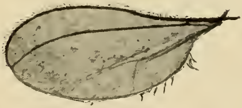
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PLATE 39

1 Wing of *Colpodia trifolii* Felt, C. 455, X 20
2 Wing of *Porricondyla hamata* Felt, a1626, X 20
3 Wing of *Holoneurus altifilus* Felt, C. 398, X 20
4 Wing of *Johnsonomyia rubra* n. sp., C. 826, X 15
5 Wing of *Porricondyla carolina* Felt, a1625, X 20
6 Wing of *Asynapta cerasi* Felt, C. 236, X 20
7 Wing of *Dirhiza canadensis* n. sp., C. 952, X 15
8 Wing of *Porricondyla flava* Felt, C. 151, X 20
9 Wing of *Winnertzia ampelophila* Felt, C. 450, X 20

Plate 39

PLATE 40

1 Genitalia of *Lobodiplosis quercina* Felt, C. 271, X 260
2 Genitalia of *Lobodiplosis acerina* Felt, C. 243, X 260

Plate 40

1

2

PLATE 41

1 Genitalia of Karshomyia viburni Felt, n. sp., C. 89, X 260

2 Genitalia of Youngomyia rubida n. sp., C. 423, X 260

Plate 41

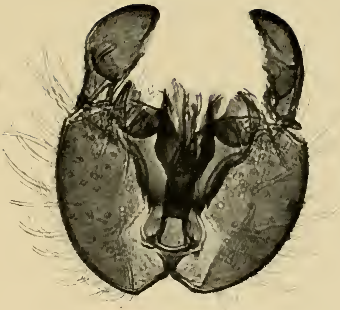

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PLATE 42

1 Genitalia of *Clinodiplosis caryae* Felt, C. 331, X 260
2 Genitalia of *Obolodiplosis orbiculata* Felt, C. 180, X 260

Plate 42

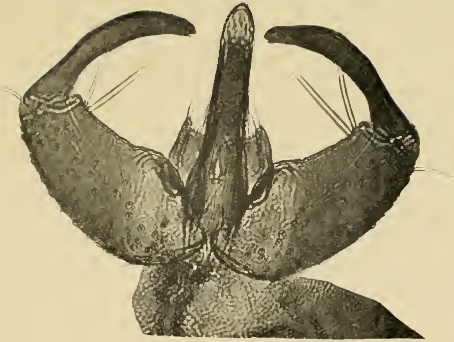

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PLATE 43

1 Genitalia of Colpodia carolinae Felt, C. a1624, X 260

2 Genitalia of Colpodia longimana n. sp., C. 830, X 260

Plate 43

1

2

PLATE 44

509

1 Genitalia of *Porricondyla pini* Felt, C. 221, X 260
2 Genitalia of *Porricondyla hamata* Felt, C. a1626, X 260

Plate 44

1

2

INDEX

New York State Education Department

New York State Museum

John M. Clarke, Director

PUBLICATIONS

Packages will be sent prepaid except when distance or weight renders the same impracticable. On 10 or more copies of any one publication 20% discount will be given. Editions printed are only large enough to meet special claims and probable sales. When the sale copies are exhausted, the price for the few reserve copies is advanced to that charged by second-hand booksellers, in order to limit their distribution to cases of special need. Such prices are inclosed in [ ]. All publications are in paper covers, unless binding is specified.

Museum annual reports 1847–date. *All in print to 1892, 50c a volume, 75c in cloth; 1892–date, 75c, cloth.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904–date.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Report for 1904. 138p. 20c. 1905. 102p. 23pl. 30c. 1906. 186p. 41pl. 35c. 1907. 212p. 63pl. 50c.

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, O: 2, 14–16, Q.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	10	$.35	18 (En 17)	$.20
2	.30	11	.25	19 (" 21)	.15
5	.25	12	.25	20 (" 24)	.40
6	.15	13	.10	21 (" 26)	.25
7	.20	14 (En 5)	.20	22 (" 28)	.25
8	.25	15 (" 9)	.15	23	.75
9	.25	16 (" 10)	.25		

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–98 are out of print Report for 1899 may be had for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), 56th (1902), 57th (1903), 58th (1904), 59th (1905) and 60th (1906) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitut Museum memoir 4.

Museum bulletins 1887–date. O. *To advance subscribers,* $2 *a year or* $1 *a year for division* (1) *geology, economic geology, paleontology, mineralogy;* 50c *each for divisions* (2) *general zoology, archeology and miscellaneous,* (3) *botany,* (4) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v.1	M 4	59, v.2	En 10	54, v.2	Ar 4	54, v.1
2	51, v.1	Pa 1	54, v.1	11	54, v.3	5	" v.3
3	52, v.1	2.3	54, v.3	12, 13	" v.4	6	55, v.1
4	54, v.4	4	" v.4	14	55, v.1	7	56, v.4
5	56, v.1	5,6	55, v.1	15–18	56, v.3	8, 9	57, v.2
6	57, v.1, pt 1	7,9	56, v.2	19–22	57, v.1, pt 2	10, 11	58, v.4
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11	59, v.1	11–14	58, v.3	25,26	59, v.2	Ms 1, 2	56, v.4
12–14	60, v.2	15, 16	59, v.2	27,28	60, v.1		
Eg 5, 6	48, v.1	17, 18	60, v.1	Bo 3	52, v.1		
7	50, v.1	Z 3	53, v.1	4	53, v.1	*Memoir*	
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9	54, v.2	5–7	" v.3	6	56, v.4	3, 4	53, v.2
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3	57, v.1, pt 1	7–9	53, v.1	3	52, v.1		

The figures in parenthesis in the following list indicate the bulletin's number as a New York State Museum bulletin.

Geology. G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. 10c.

G2 (19) Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. *Out of print.*

G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. 5c.

G4 (48) Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. 25c.

G5 (56) Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. 10c.

G6 (77) Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. 30c.

G7 (83) Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. 62p. 25pl. map. June 1905. 25c.

G8 (84) —— Ancient Water Levels of the Champlain and Hudson Valleys. 206p. 11pl. 18 maps. July 1905. 45c.

G9 (95) Cushing, H. P. Geology of the Northern Adirondack Region. 188p. 15pl. 3 maps. Sep. 1905. 30c.

G10 (96) Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. 54p. il. 17pl. map. Dec. 1905. 30c.

G11 (106) Fairchild, H L. Glacial Waters in the Erie Basin. 88p. 14pl. 9 maps. Feb. 1907. *Out of print.*

G12 (107) Woodworth, J. B.; Hartnagel, C. A.; Whitlock, H. P.; Hudson, G. H.; Clarke, J. M.; White, David; Berkey, C. P. Geological Papers. 388p. 56pl. map. May 1907. 90c, *cloth.*

Contents: Woodworth, J. B. Postglacial Faults of Eastern New York.
Hartnagel, C. A. Stratigraphic Relations of the Oneida Conglomerate
—— Upper Siluric and Lower Devonic Formations of the Skunnemunk Mountain Region.
Whitlock, H. P. Minerals from Lyon Mountain, Clinton Co.
Hudson, G. H. On Some Pelmatozoa from the Chazy Limestone of New York.
Clarke, J. M. Some New Devonic Fossils.
—— An Interesting Style of Sand-filled Vein.
—— Eurypterus Shales of the Shawangunk Mountains in Eastern New York.
White, David. A Remarkable Fossil Tree Trunk from the Middle Devonic of New York.
Berkey, C. P. Structural and Stratigraphic Features of the Basal Gneisses of the Highlands.

G13 (111) Fairchild, H. L. Drumlins of New York. 58p. 28pl. 19 maps. July 1907. *Out of print.*

G14 (115) Cushing, H. P. Geology of the Long Lake Quadrangle. 88p. 20pl. map. Sep. 1907. 25c.

Fairchild, H. L. Later Glacial Waters in Central New York. *In press.*

Miller, W. J. Geology of the Remsen Quadrangle. *In press.*

Berkey, C. P. Geology of the Highlands of the Hudson. *In preparation.*

Cushing, H. P. Geology of the Theresa Quadrangle. *In preparation.*

Economic geology. Eg1 (3) Smock, J. C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

Eg2 (7) —— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p map. June 1889 *Out of print.*
Eg3 (10) —— Building Stone in New York. 210p. map. tab. Sep. 1890. 40c.
Eg4 (11) Merrill, F. J. H. Salt and Gypsum Industries of New York. 92p. 12pl. 2 maps, 11 tab. Ap. 1893. [50c]
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Eg9 (35) Ries, Heinrich. Clays of New York; their Properties and Uses. 456p. 140pl. map. June 1900. $1, *cloth.*
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